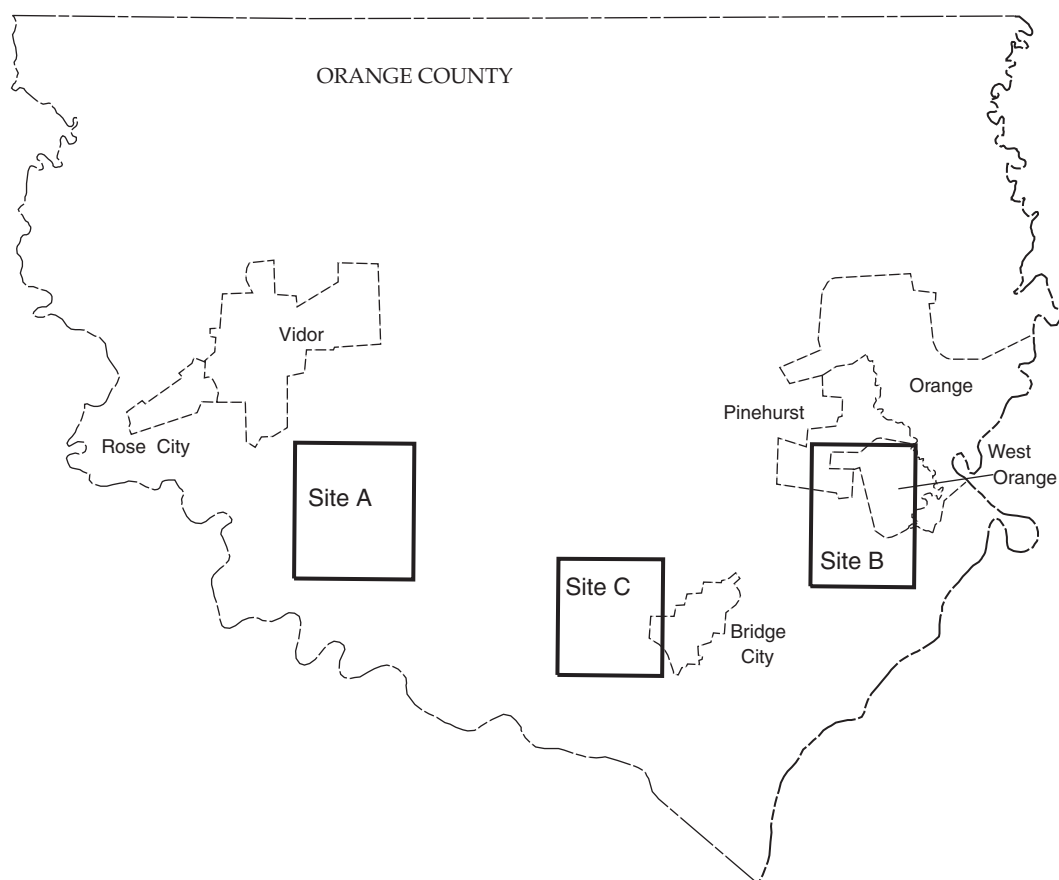


In cooperation with the Orange County Commissioner's Court

# Ground-Water Data in Orange County and Adjacent Counties, Texas, 1985–90

Open-File Report 99–603

---



---

U.S. Department of the Interior  
U.S. Geological Survey

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>1999</b>		2. REPORT TYPE <b>N/A</b>		3. DATES COVERED <b>-</b>	
4. TITLE AND SUBTITLE <b>Ground-Water Data in Orange County and Adjacent Counties, Texas, 1985-90</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>U.S. Department of the Interior 1849 C Street, NW Washington, DC 20240</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release, distribution unlimited</b>					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>SAR</b>	18. NUMBER OF PAGES <b>38</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

**U.S. Department of the Interior  
U.S. Geological Survey**

# **Ground-Water Data in Orange County and Adjacent Counties, Texas, 1985–90**

**By Mark C. Kasmarek**

**U.S. GEOLOGICAL SURVEY  
Open-File Report 99–603**

**In cooperation with the Orange County Commissioner's Court**

**Austin, Texas  
1999**

## **U.S. DEPARTMENT OF THE INTERIOR**

Bruce Babbitt, Secretary

## **U.S. GEOLOGICAL SURVEY**

Charles G. Groat, Director

Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

**For additional information write to**

**District Chief  
U.S. Geological Survey  
8027 Exchange Dr.  
Austin, TX 78754-4733  
E-mail: [dc\\_tx@usgs.gov](mailto:dc_tx@usgs.gov)**

**Copies of this report can be purchased from**

**U.S. Geological Survey  
Branch of Information Services  
Box 25286  
Denver, CO 80225-0286  
E-mail: [infoservices@usgs.gov](mailto:infoservices@usgs.gov)**

# CONTENTS

Abstract .....	1
Introduction .....	1
Purpose and Scope .....	3
Acknowledgments .....	3
Well-Numbering System .....	3
Hydrogeology .....	3
Ground-Water Resources .....	5
Withdrawals .....	5
Water Levels .....	5
Altitudes in April 1990 .....	6
Changes During 1971–90 and 1985–90 .....	6
Water Quality .....	6
Changes in Dissolved Chloride Concentrations .....	8
Relation Between Specific Conductance and Dissolved Chloride Concentrations .....	8
Summary .....	15
Selected References .....	15
Glossary .....	16

## PLATES

### Plates are in pocket

- 1–5. Maps showing:
  1. Locations of selected wells in Orange County and adjacent counties, Texas
  2. Approximate water-level altitudes in wells screened in the lower unit of the Chicot aquifer in Orange County and adjacent counties, Texas, 1990
  3. Approximate water-level changes in wells screened in the lower unit of the Chicot aquifer in Orange County and adjacent counties, Texas, 1971–90
  4. Approximate water-level changes in wells screened in the lower unit of the Chicot aquifer in Orange County and adjacent counties, Texas, 1985–90
  5. Distribution of dissolved chloride concentrations in water from wells screened in the lower unit of the Chicot aquifer in Orange County, Texas, November–December 1989

## FIGURES

- 1–2. Maps showing:
  1. Location of study area ..... 2
  2. Approximate altitude of the base of the Chicot aquifer in Orange County, Texas ..... 4
3. Hydrographs showing changes in water levels in wells screened in the lower unit of the Chicot aquifer in Orange County, Texas ..... 7
4. Conceptual profiles showing (a) relation between freshwater and saline water before pumping begins and (b) development of a saline-water cone during pumping ..... 9
- 5–6. Maps showing dissolved chloride concentrations in water from selected wells screened in the lower unit of the Chicot aquifer at:
  5. Site A in southwestern Orange County, Texas, November 1985 ..... 10
  6. Site B in southeastern Orange County, Texas, (a) November 1985, (b) October–November 1986, and (c) October 1988 ..... 11
7. Graph showing relation between specific conductance and dissolved chloride concentrations in water from wells screened in the lower unit of the Chicot aquifer, Orange County, Texas, 1985–89 ..... 14

## TABLES

1. Hydrogeologic correlations for Orange County and adjacent counties, Texas .....	17
2. Average daily rates of ground-water withdrawals for municipal and industrial use from the lower unit of the Chicot aquifer in Orange County, Texas, 1980–89, in million gallons per day .....	17
3. Average daily rates of ground-water withdrawals from the lower unit of the Chicot aquifer at major industrial sites in Orange County, Texas, 1980–89, in million gallons per day .....	18
4. Average daily rates of surface water supplied for municipal and industrial use in Orange County, Texas, 1980–89, in million gallons per day .....	18
5. Average daily rates of ground-water withdrawals from the Evangeline aquifer and lower unit of the Chicot aquifer for public supply in eastern Jefferson, eastern Hardin, and southern Jasper Counties, Texas, 1985–89, in million gallons per day .....	18
6. Water levels in observation wells in Orange County and adjacent counties, Texas, 1985–90 .....	19
7. Records of selected wells in Orange County, Texas, 1985–90 .....	27
8. Chemical analyses of water from selected wells in Orange County, Texas, 1985–90 .....	28

## VERTICAL DATUM AND ABBREVIATIONS

**Sea level:** In this report “sea level” refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

### Abbreviations:

°C, degree Celsius  
ft, foot  
in., inch  
mg/L, milligram per liter  
mi, mile  
Mgal/d, million gallons per day  
μS/cm, microsiemens per centimeter at 25 degrees Celsius

# Ground-Water Data in Orange County and Adjacent Counties, Texas, 1985–90

By Mark C. Kasmarek

## Abstract

The lower unit of the Chicot aquifer is a major source of freshwater for Orange County, Texas. In 1989, the average rate of ground-water withdrawal from the lower unit of the Chicot aquifer in Orange County for municipal and industrial use was 13.8 million gallons per day, a substantial decrease from the historical high of 23.1 million gallons per day in 1972. The average withdrawal for industrial use decreased substantially from 14.4 million gallons per day during 1963–84 to 6.9 million gallons per day during 1985–89. The average withdrawal for municipal use during 1985–89 was 6.8 million gallons per day, similar to the average withdrawal of 5.8 million gallons per day during 1963–84.

Water levels in wells in most of the study area rose during 1985–90. The largest rise in water levels was more than 10 feet in parts of Orange and Pinehurst, north of site B (one of three areas of ground-water withdrawal for industrial use), while the largest decline in water levels was a localized decline of more than 60 feet at site C in south-central Orange County (also an area of withdrawal for industrial use).

Chemical analyses of ground-water samples from the lower Chicot aquifer during 1985–90 indicate that the aquifer contained mostly fresh-water (dissolved solids concentrations less than 1,000 milligrams per liter). Dissolved chloride concentrations remained relatively constant in most wells during 1985–90 but could vary greatly between wells within short distances. Saline-water encroachment continued to occur during 1985–89 but at a slower rate than in the 1970s and early 1980s. On the basis of chemical data collected

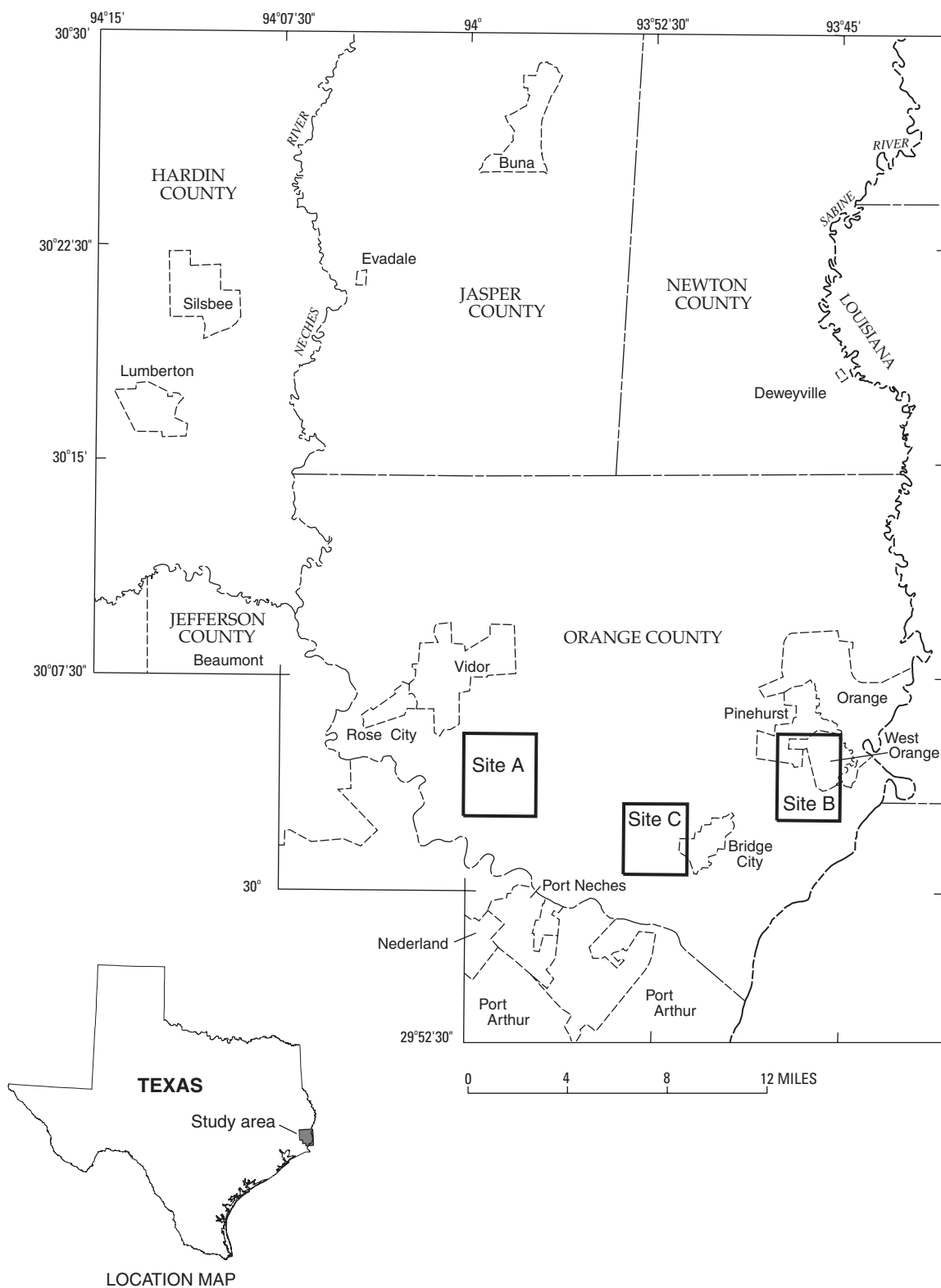
during 1985–89, a relation was determined between specific conductance and dissolved chloride concentration that can be used to estimate dissolved chloride by multiplying the specific conductance by different factors for low or high conductances.

## INTRODUCTION

A continuing program to study the ground-water resources in Orange County and adjacent counties in Texas was begun in March 1967 by the U.S. Geological Survey in cooperation with the Texas Water Development Board and the Sabine River Authority. Since 1979, this program has been conducted in cooperation with the Orange County Commissioner's Court. Orange County is the principal part of the study area (fig. 1) where data were collected pertinent to the ground-water resources. Ancillary data were collected in adjacent Hardin, Jasper, Jefferson, and Newton Counties.

The ground-water program, which consists of monitoring and appraising withdrawals of ground water, water levels, and water quality, was initiated to document water-level changes and saline-water encroachment. The overall objectives of the program are to provide the following:

1. An inventory of all new large-capacity wells and the compilation of drillers logs.
2. The establishment and maintenance of a network of observation wells for monitoring changes in water levels and water quality, especially dissolved chloride concentrations.
3. An annual inventory of withdrawal for municipal supply and industrial use.
4. The correlation of current data with previously collected data.



**Figure 1.** Location of study area.



## Purpose and Scope

This report presents a brief discussion on the hydrogeology of the area and an evaluation of the ground-water data collected during April 1985–April 1990. The data include ground-water withdrawals from the Chicot and Evangeline aquifers, water-level altitudes and changes in wells in the Chicot aquifer, and water quality in wells in the Chicot aquifer.

## Acknowledgments

Special thanks are extended to the many land owners and industry and city officials who provided data and granted access to water-well sites. Mr. Bill Moltz, Texas Water Development Board, Austin, Texas, tabulated the ground-water withdrawal and surface-water pumpage data used in this report.

## Well-Numbering System

The well-numbering system in Texas was developed by the Texas Water Development Board for use throughout the State. Under this system, each 1-degree quadrangle is given a number consisting of two digits. These are the first two digits in the well number. Each 1-degree quadrangle is divided into 7-1/2-minute quadrangles that are given a two-digit number from 01 to 64. These are the third and fourth digits of the well number. Each 7-1/2-minute quadrangle is divided into 2-1/2-minute quadrangles that are given a single-digit number from 1 to 9. This is the fifth digit of the well number. Finally, each well within a 2-1/2-minute quadrangle is given a 2-digit number in the order in which it was inventoried, starting with 01. These are the last two digits of the well number.

In addition to the seven-digit well number, a two-letter prefix is used to identify the county where the well is located. The prefixes for the counties in the study are: Orange, UJ; Hardin, LH; Jasper, PR; Jefferson, PT; and Newton, TZ.

On plate 1, only the last three digits of the well number are shown at each well location where data were collected; the second two digits are shown in the corner of each 7-1/2-minute quadrangle; and the first two digits are shown by the large block numerals adjacent to each

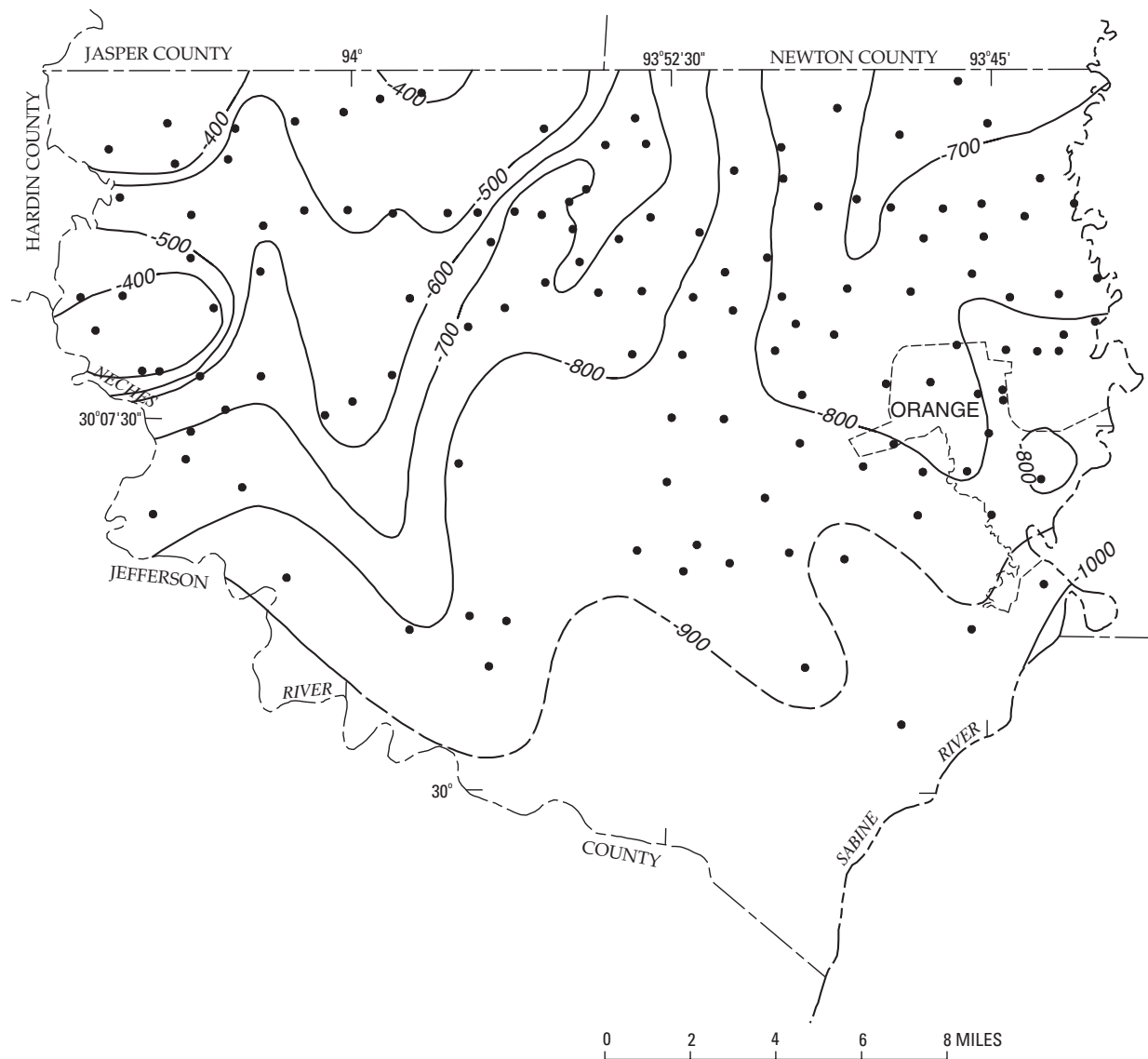
1-degree quadrangle. Plate 1 shows the locations of wells that were inventoried during 1985–90 plus locations of a representative number of wells inventoried during preceding periods.

## HYDROGEOLOGY

The hydrologic and geologic units in Orange County have been described by Wesselman (1965), Gabrysch and McAdoo (1972), and Nyman (1984). Harder (1960) and Harder and others (1967) defined the hydrologic units in southwestern Louisiana. This report uses the classification of Nyman (1984) with slight modification. Hydrogeologic correlations for Orange County and adjacent counties are summarized in table 1 (at end of report).

The Chicot aquifer, underlying all of the study area at various depths, stratigraphically is the shallowest principal aquifer in the study area and is of Pleistocene age. The Chicot aquifer is divided into two sand units by clay beds that, although not areally continuous, do separate an upper sand unit from a lower sand unit stratigraphically (table 1). The altitude of the base of the Chicot aquifer ranges from less than 400 ft below sea level in northwestern Orange County to about 1,000 ft below sea level in southeastern Orange County (fig. 2). Electric logs of some wells show a thick high-resistivity sand at the base of the Chicot aquifer, and this sand acts as a well-defined markerbed (Turcan and others, 1966). The lower unit of the Chicot aquifer is a major source of freshwater for Orange County.

The Evangeline aquifer underlies the Chicot aquifer and consists of sediments of Pliocene and Miocene age. The differentiation of the Evangeline aquifer from the Chicot aquifer is made on the basis of grain size. The Evangeline aquifer consists of finer grained sediments than the Chicot aquifer, which consists chiefly of coarse sand and gravel and has a greater sand-to-clay ratio. The sediments of the Evangeline aquifer are less permeable and have lower rates of transmissivity than the Chicot aquifer. Laterally continuous clay beds are not present to separate the two aquifers; this lack of clay beds allows the waters of the aquifers to intermix. The amount of intermixing is dependent on the fluctuating



#### EXPLANATION

— -800 — — **Structure contour**—Shows altitude of base of Chicot aquifer. Dashed where approximately located. Contour interval 100 feet. Datum is sea level

• **Well used for control**

**Figure 2.** Approximate altitude of the base of the Chicot aquifer in Orange County, Texas (modified from Gabrysch and McAdoo, 1972).

hydraulic gradient caused by withdrawal at concentrated pumping centers like those at sites A, B, and C (fig. 1). The Evangeline aquifer contains freshwater only in the extreme northwestern part of Orange County.

## **GROUND-WATER RESOURCES**

### **Withdrawals**

Ground-water withdrawals from the lower unit of the Chicot aquifer during 1985–89 were reported by major water users to the Texas Water Development Board. Information on ground-water withdrawals during 1963–84 were published in a previous report (Bonnet and Williams, 1987, p. 13). Average daily rates of ground-water withdrawals from the lower unit of the Chicot aquifer in Orange County during 1980–89 are listed in table 2 (at end of report). The data for 1980–84 are included to indicate historical trends.

The major water users in Orange County did not report any ground-water withdrawals from the upper unit of the Chicot aquifer during 1980–89. Consequently, the withdrawals from this unit are unknown but are believed to be isolated and few.

Average daily rates of ground-water withdrawals for combined municipal and industrial use in Orange County ranged from 13.1 to 20.1 Mgal/d during 1980–89 and ranged from 13.1 to 14.6 Mgal/d during 1985–89. Because of declining economic conditions and recycling of some of the water used for industrial purposes, the average withdrawal of 6.9 Mgal/d during 1985–89 for industrial use was a substantial decrease from the average of 14.4 Mgal/d during 1963–84 (Bonnet and Williams, 1987, table 2). This is in contrast to the average withdrawal of about 6.8 Mgal/d during 1985–89 for municipal use, which was a 1.0 Mgal/d increase over the average of 5.8 Mgal/d during 1963–84 (Bonnet and Williams, 1987, table 2). During 1985–89, withdrawals for municipal use ranged from 6.4 to 7.1 Mgal/d, similar to withdrawals for industrial use, which ranged from 6.4 to 7.5 Mgal/d. The combined municipal and industrial average ground-water withdrawal in 1989 was 13.8 Mgal/d, a substantial decrease from the historical high of 23.1 Mgal/d in 1972 (Bonnet and Williams, 1987, table 2). Most ground water used for industrial purposes was withdrawn at three locations: southeast of the city of Vidor (site A);

southwest of the city of Orange, which includes the petrochemical industrial area (site B); and south-central Orange County (site C) (fig. 1). Average daily rates of ground-water withdrawals at these sites during 1980–89 are listed in table 3 (at end of report). The average daily rates of ground-water withdrawals show little year-to-year variability at each location during 1985–89 and were less than the rates during 1980–84.

Surface-water use in Orange County during 1980–89 (table 4 at end of report) was considerably more than ground-water use. Surface water supplied for municipal and industrial use was about 2.5 times the ground-water withdrawals for municipal and industrial use in 1980 and more than 3 times the withdrawals in 1989.

Water for the cities of Beaumont in Jefferson County, Silsbee and Lumberton in Hardin County, and Buna and Evadale in Jasper County is pumped from wells with screened intervals in the Chicot and Evangeline aquifers; therefore, the withdrawal from each individual aquifer is unknown. The estimated ground-water withdrawals during 1985–89 from the Evangeline aquifer and lower unit of the Chicot aquifer for these municipalities are listed in table 5 (at end of report).

### **Water Levels**

Static water-level measurements, used to prepare regional water-level altitude maps, are made in the spring of each year when ground-water withdrawals are minimal (principally as a result of decreased agricultural withdrawals) and when ground-water levels usually are at their highest altitude. Measurements made during 1985–90 are listed in table 6 (at end of report).

Water-level measurements made before 1985 in wells located in the western part of Louisiana adjacent to the Sabine River were used to prepare water-level maps for previous reports (Gabrysch and McAdoo, 1972; Bonnet, 1975; Bonnet and Gabrysch, 1983; and Bonnet and Williams, 1987). Measurements were not made in those wells during 1985–89 because the program that covered this geographic area in Louisiana was discontinued.

## Altitudes in April 1990

The approximate altitudes of water levels measured in wells screened in the lower unit of the Chicot aquifer during April 1990 are shown in plate 2. Water levels in wells in Orange County were about 20 to 30 ft below sea level in the central and west-central parts; about 10 to 20 ft below sea level in the northern part; about 30 to more than 40 ft below sea level in the eastern part near the city of Orange; and about 20 to more than 90 ft below sea level in south-central Orange County at site C.

## Changes During 1971–90 and 1985–90

Water-level changes during 1971–90 (pl. 3) generally ranged from a decline of more than 20 ft to a rise of more than 10 ft. However, in south-central Orange County, concentrated pumping at site C resulted in estimated declines of more than 10 ft. Water levels in wells rose more than 10 ft south of the city of Orange near the petrochemical industrial area in and near site B. Water levels in wells in Vidor declined as much as 5 ft in the northwestern part of the city, and rose less than 5 ft in the eastern part.

Water-level changes during 1985–90 (pl. 4) ranged from a localized decline of more than 60 ft at site C in south-central Orange County, to a local rise of more than 10 ft in parts of Orange and Pinehurst, north of site B. Water levels generally remained about constant in West Orange and at site B in the petrochemical industrial area. Near Vidor and at site A, water levels in wells rose less than 10 ft. The general rise in water levels during 1985–90 throughout most of Orange County is related to the decrease in withdrawal rates (tables 2 and 3) resulting from the decline in economic conditions and the reuse of some of the ground water pumped for industrial purposes during that period.

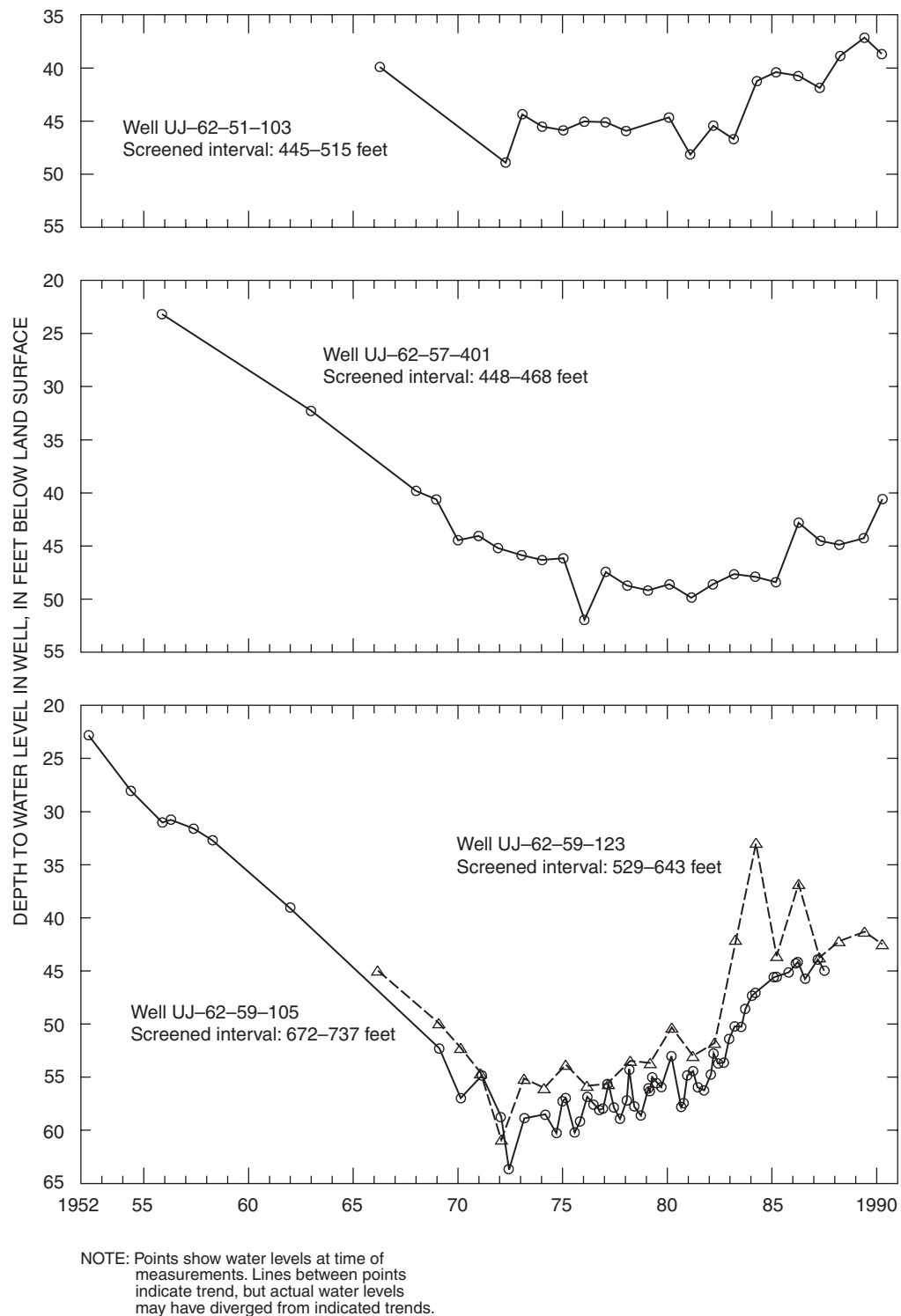
Long-term hydrographs of four wells in the study area are shown in figure 3. Well UJ–62–51–103 is located in the northeast corner of Orange County; well UJ–62–57–401 is located in southwestern Orange County; and wells UJ–62–59–105 and UJ–62–59–123 are located in the city of Orange (pl. 1). The hydrographs in figure 3 show declining water levels into the early to mid-1970s, at which time water levels stabilized. In the early 1980s, water levels slowly began to rise. Hydrographs of wells UJ–62–51–103 and UJ–62–57–401 show net water-level rises of about

1.7 and 8 ft, respectively, from 1985 to 1990. The hydrograph of water levels in well UJ–62–59–123 shows a net water-level rise of about 2.4 ft from 1966 to 1990, and the hydrograph of water levels in well UJ–62–59–105, which was discontinued in August 1987, shows a net water-level decline of about 22 ft from 1952 to 1987. The records of selected wells for newly inventoried sites during 1985–90 are presented in table 7 (at end of report). Records of older wells in Orange County and vicinity are given in various previous reports such as Bonnet (1975), Bonnet and Gabrysch (1983), Bonnet and Williams (1987), Gabrysch and McAdoo (1972), McAdoo (1968–70), and Wesselman (1965).

## Water Quality

The chemical analyses of water samples collected from selected wells during 1985–90 are listed in table 8 (at end of report). The analyses consisted of specific conductance, pH, temperature (all determined in the field), and dissolved chloride concentration (determined in the laboratory). In 1985 the specific conductance ranged from 180 to 4,140  $\mu\text{S}/\text{cm}$  in water from wells UJ–62–49–302 and UJ–62–58–605, respectively. The pH ranged from 6.6 standard units in water from wells UJ–62–50–106 (November 29, 1989) and UJ–62–58–305 (October 27, 1987) to 8.4 standard units in water from well UJ–62–57–401 (December 6, 1989). Water temperature ranged from 18.0 °C in well UJ–62–50–807 on November 29, 1989, to 26.0 °C in well UJ–62–58–608 on October 18, 1988. The dissolved chloride concentrations ranged from 14 mg/L in water collected from well UJ–62–49–905 (November 12, 1985) to 1,200 mg/L in well UJ–62–58–605 (November 14, 1985; November 6, 1986; October 26, 1988). Most of the wells sampled in the lower Chicot aquifer during 1985–89 contained freshwater (dissolved solids concentrations less than 1,000 mg/L (Winslow and Kister, 1956)). Furthermore, dissolved chloride concentrations in water from most wells in the lower Chicot aquifer within the study area showed little variation during 1985–90.

Secondary maximum contaminant levels (SMCL), nonenforceable guidelines based on taste, odor, and color, were established by the U.S. Environmental Protection Agency (1996) for selected properties and constituents in drinking water. pH in samples



**Figure 3.** Hydrographs showing changes in water levels in wells screened in the lower unit of the Chicot aquifer in Orange County, Texas.

collected during 1985–90 (table 8) from public-supply, livestock, and domestic wells was within the SMCL range of 6.5 to 8.5 standard units. During 1985–90, dissolved chloride concentrations (table 8) in many wells at sites A and B (where the majority of industrial wells are located) were greater than the SMCL of 250 mg/L. However, most of the wells in the northern two-thirds of the county (where the majority of public-supply, livestock, and domestic wells are located) had dissolved chloride concentrations less than 250 mg/L; many of these wells had concentrations less than 100 mg/L.

The geographic distribution of dissolved chloride concentrations in water from wells screened in the lower unit of the Chicot aquifer in Orange County during November–December 1989 is shown in plate 5. Sites A and B, areas with large rates of ground-water withdrawal in Orange County, had the largest dissolved chloride concentrations, ranging from 290 to 740 mg/L, and some of the smallest dissolved chloride concentrations, 20 mg/L at site B and 28 mg/L at site A.

### **Changes in Dissolved Chloride Concentrations**

In coastal areas, many aquifers historically (before development) have contained freshwater and saline water, with the less dense freshwater above the more dense saline water. Ground-water withdrawal can cause mixing of freshwater and saline water within the aquifer depending on numerous factors, the most important being hydrogeologic properties of the aquifer; altitude of the freshwater/saline-water interface; depth of screened intervals in wells; and rate of ground-water withdrawal from wells. A well, or more commonly a site with numerous wells, with a large rate of ground-water withdrawal can cause the saline water to be drawn upward towards the land surface and into the screened interval. This saline-water encroachment causes an increase in the dissolved chloride concentration of the water and can result in saline-water “upconing.” Conceptualized profiles of this process are shown in figure 4. This process is indicated when a well (or group of wells) with water having a large dissolved chloride concentration is surrounded by wells (screened at essentially the same interval) with water having smaller dissolved chloride concentrations. The dissolved chloride concentrations in water from several wells at site A were measured in November 1985

(fig. 5). The dissolved chloride concentration in water from well UJ–62–57–404 was substantially greater than concentrations from five of the wells surrounding it, indicating upconing at this site.

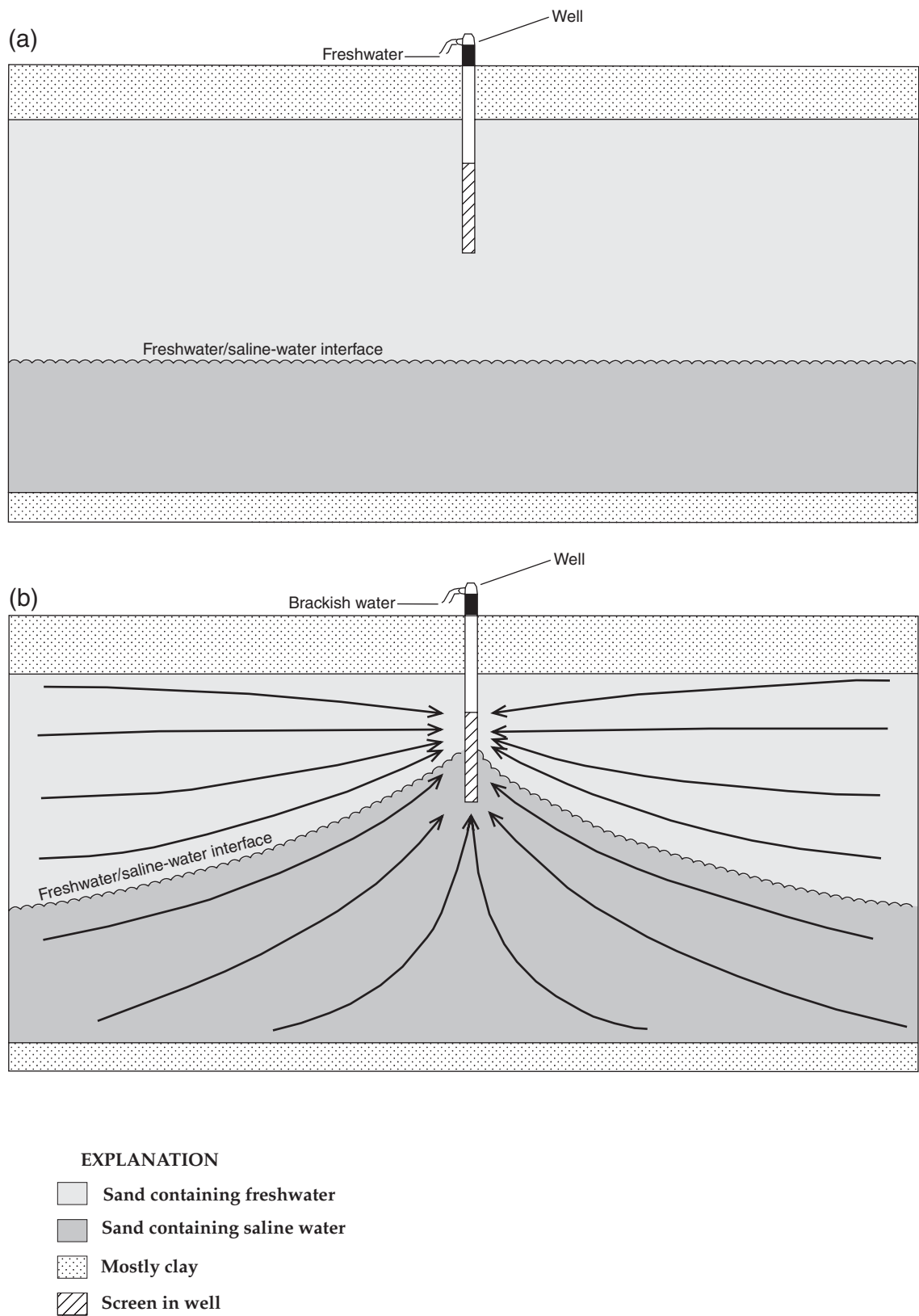
Saline-water encroachment is shown by data at site B near the city of Orange (fig. 6). The dissolved chloride concentrations in water from wells located at site B ranged from 14 mg/L in the central part of the site in 1972 to 1,500 mg/L in the southwestern part in 1974 (Bonnet, 1975, table 3). During 1985–89, dissolved chloride concentrations ranged from 21 mg/L in water from well UJ–62–58–642 in the central part of site B to 1,200 mg/L in water from well UJ–62–58–605 in the southwestern part of site B (table 8).

The steepness of the slope of the freshwater/saline-water interface is shown by dissolved chloride concentrations in water from two wells, UJ–62–58–605 and UJ–62–58–635, located within 0.2 mi of each other (fig. 6). The wells are screened at comparable depths and yielded water in November 1985 with dissolved chloride concentrations of 1,200 and 34 mg/L, respectively (fig. 6a). The concentrations of dissolved chloride in water from these two wells were 1,200 and 34 mg/L, respectively, in November 1986 (fig. 6b) and 1,100 and 31 mg/L, respectively, in November 1987 (table 8). Samples for chemical analyses were not collected from well UJ–62–58–635 in 1988 or 1989.

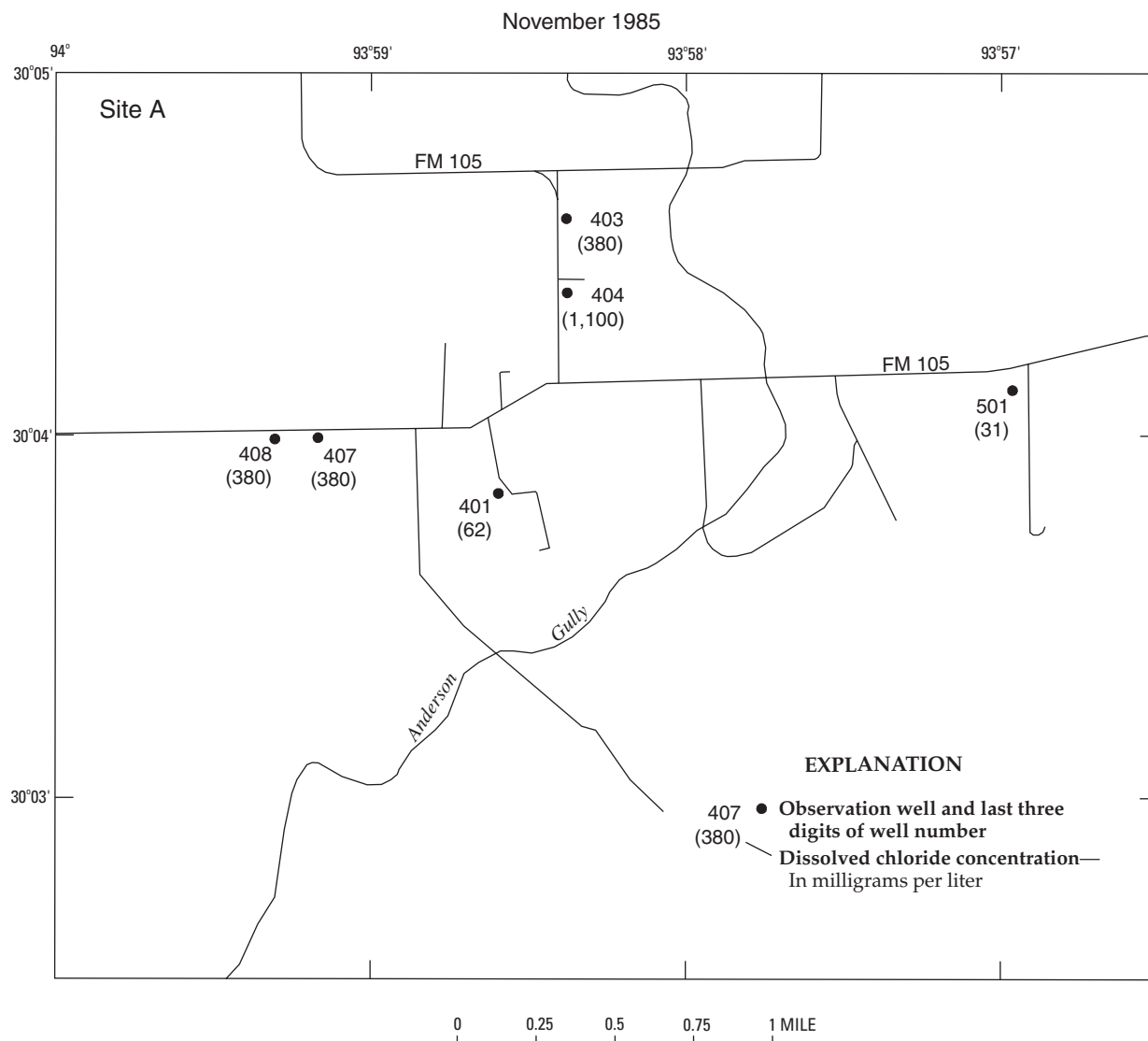
To mitigate the effects of saline-water encroachment, ground-water users in areas of Orange County with large rates of ground-water withdrawal and subsequent elevated dissolved chloride concentrations used the following techniques: alternating pumping between available wells; carefully monitoring withdrawal rates, specific conductivities, and dissolved chloride concentrations; supplementing ground-water withdrawals with surface-water pumpage; and recycling the water used for industrial purposes.

### **Relation Between Specific Conductance and Dissolved Chloride Concentrations**

A generalized relation between specific conductance and dissolved chloride concentration in water from wells screened in the lower unit of the Chicot aquifer in Orange County and sampled during 1985–89 is



**Figure 4.** Conceptual profiles showing (a) relation between freshwater and saline water before pumping begins and (b) development of a saline-water cone during pumping (modified from Nyman, 1984).



**Figure 5.** Dissolved chloride concentrations in water from selected wells screened in the lower unit of the Chicot aquifer at site A in southwestern Orange County, Texas, November 1985.

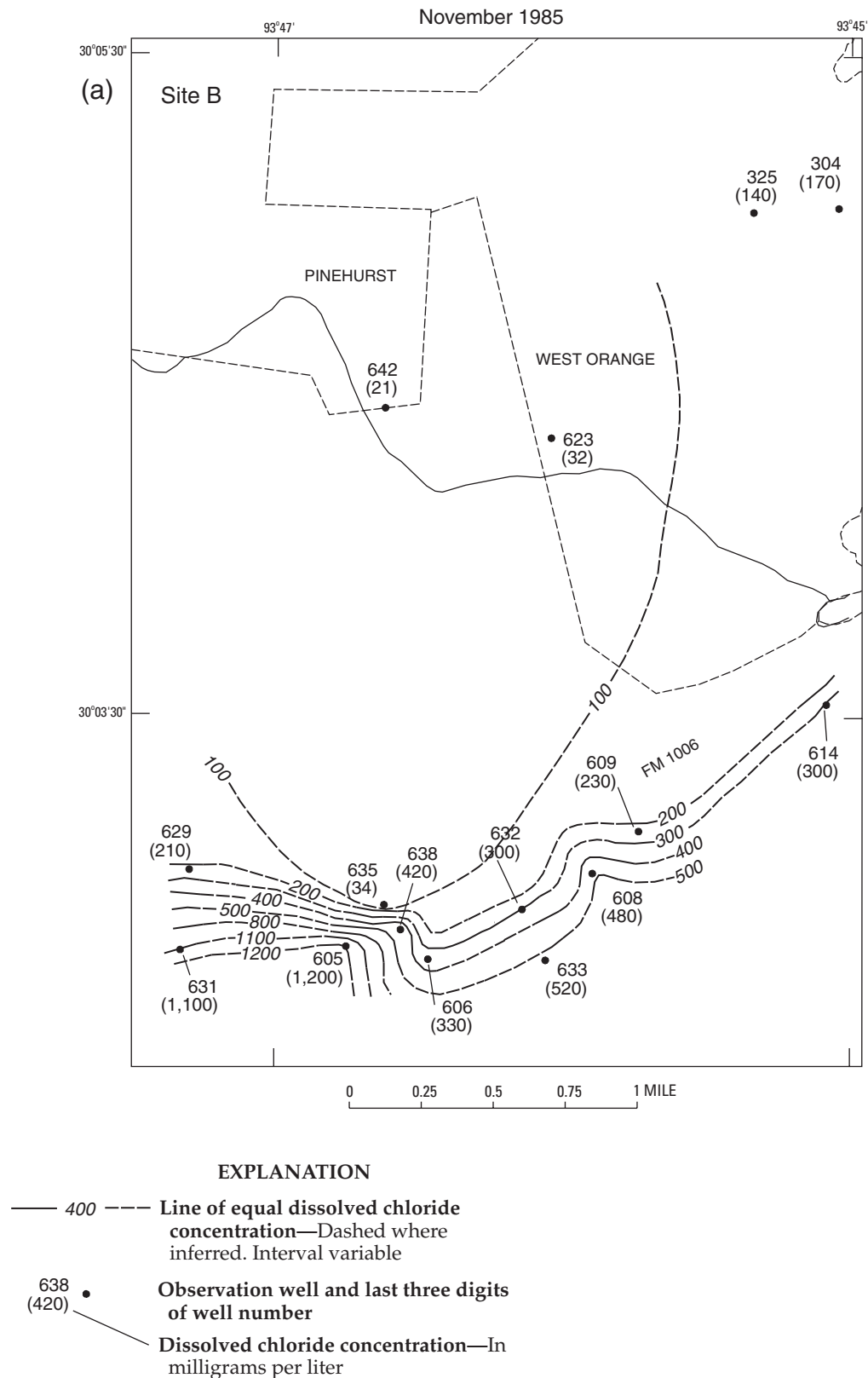
shown in figure 7. A statistical linear regression was used to determine a line that best fit all data using the equation:

$$\begin{aligned} &\text{Dissolved chloride} \\ &\text{concentration} = (3.1759) \text{ specific conductance} \\ &\quad + 325.2591. \end{aligned}$$

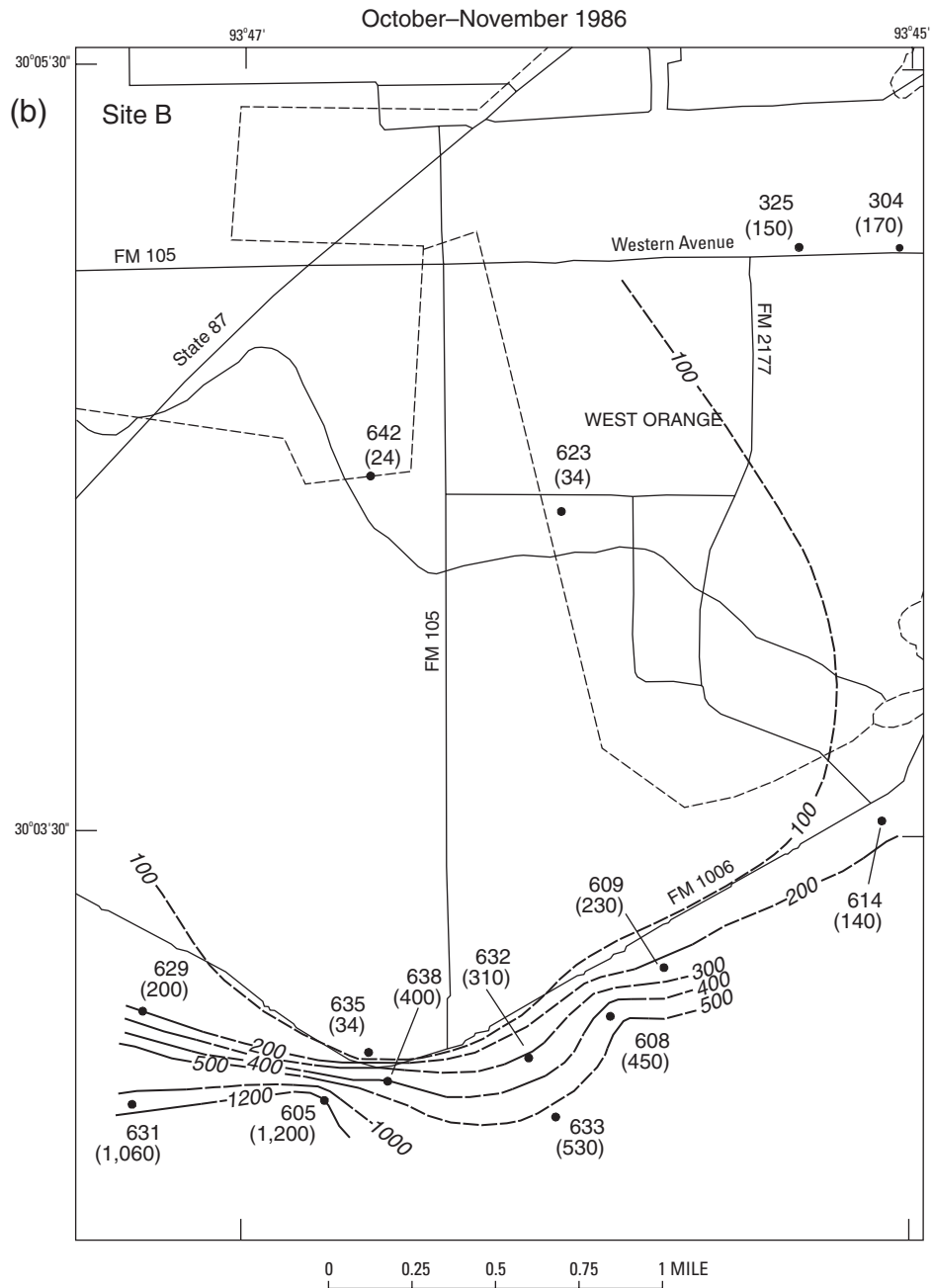
As shown by figure 7, the relation between these two constituents is approximately linear when specific conductances range between 800 and 2,500  $\mu\text{S}/\text{cm}$ . The plot also shows that the equation is less

accurate and the relation becomes nonlinear when specific conductances are less than 800  $\mu\text{S}/\text{cm}$  or greater than 2,500  $\mu\text{S}/\text{cm}$ . The nonlinear relations are probably caused by concentrations of other dissolved ions in the ground water and also by the greater density of data values in the mid to lower range. This relation is applicable only for samples collected in Orange County. Because specific-conductance measurements can be made easily and inexpensively at the well site, the relation shown can be used to determine approximate concentrations of dissolved chloride.





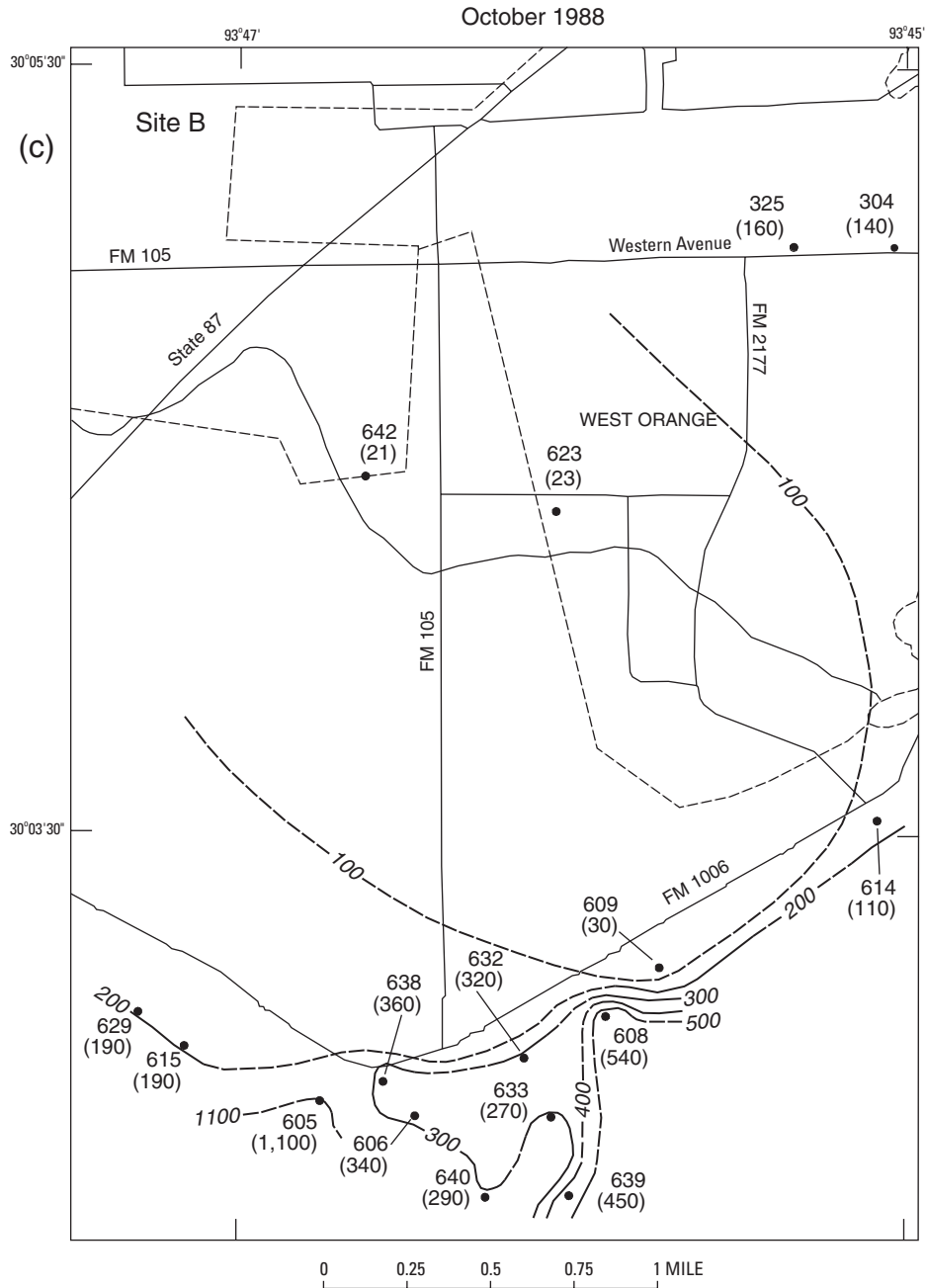
**Figure 6.** Dissolved chloride concentrations in water from selected wells screened in the lower unit of the Chicot aquifer at Site B in southeastern Orange County, Texas, (a) November 1985, (b) October–November 1986, and (c) October 1988.



#### EXPLANATION

- 400 — Line of equal dissolved chloride concentration—Dashed where inferred. Interval variable
- 638 (400) • Observation well and last three digits of well number
- Dissolved chloride concentration—In milligrams per liter

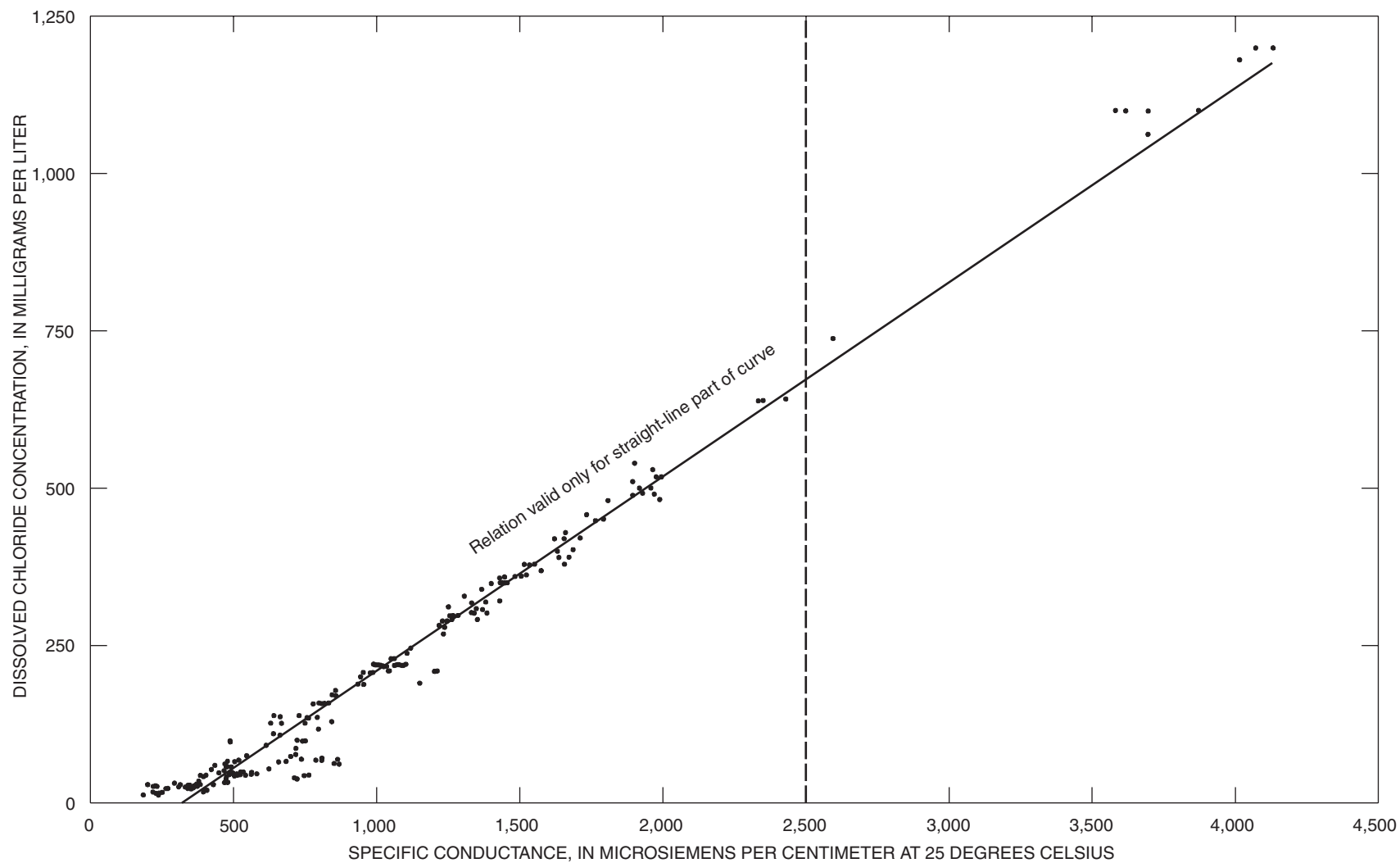
**Figure 6.**—Continued.



#### EXPLANATION

- Line of equal dissolved chloride concentration—Dashed where inferred. Interval, in feet, is variable
- Observation well and last three digits of well number
- Dissolved chloride concentration—In milligrams per liter

Figure 6.—Continued.



**Figure 7.** Relation between specific conductance and dissolved chloride concentrations in water from wells screened in the lower unit of the Chicot aquifer, Orange County, Texas, 1985-89.

## SUMMARY

The lower unit of the Chicot aquifer is a major source of freshwater for Orange County, Texas. The lower unit of the aquifer, separated from the upper unit by clay beds, is Pleistocene in age and underlies all of the study area at varying depths. The altitude of the base of the aquifer ranges from less than 400 ft below sea level in northwestern Orange County to about 1,000 ft below sea level in southeastern Orange County.

In 1989, the average rate of ground-water withdrawals from the lower unit of the Chicot aquifer in Orange County for combined municipal and industrial use was 13.8 Mgal/d, a substantial decrease from the historical high of 23.1 Mgal/d in 1972. Average annual withdrawals for municipal and industrial use were similar for 1985–89, ranging from 13.1 to 14.6 Mgal/d. The average withdrawal for industrial use decreased substantially from 14.4 Mgal/d during 1963–84 to 6.9 Mgal/d during 1985–89. The average withdrawal for municipal use during 1985–89 was 6.8 Mgal/d, similar to the average withdrawal of 5.8 Mgal/d during 1963–84.

Water levels in wells in most of the study area rose during 1985–90 because of decreased ground-water withdrawal associated with declining economic conditions and recycling of some of the water used for industrial purposes during that period. The largest rise in water levels was more than 10 ft in parts of Orange and Pinehurst, north of site B, while the largest decline in water levels was a localized decline of more than 60 ft at site C in south-central Orange County.

Chemical analyses of ground-water samples from the lower Chicot aquifer during 1985–90 indicate that the aquifer contained mostly freshwater (dissolved solids concentrations less than 1,000 mg/L). Dissolved chloride concentrations in most wells within the study area remained relatively constant during 1985–90. However, the distribution of dissolved chloride showed that, in some areas, concentrations could vary greatly between wells within short distances. The data also indicate that the saline-water encroachment, primarily by saline-water upconing, continued to occur during 1985–89, but in smaller dissolved chloride concentrations and at a slower rate compared to the 1970s and early 1980s. To mitigate the effects of saline-water encroachment, ground-water users in areas with large rates of ground-water withdrawal and large dissolved

chloride concentrations used the following techniques: alternating pumping between available wells; carefully monitoring withdrawal rates, specific conductivities, and dissolved chloride concentrations; supplementing ground-water withdrawals with surface-water pumpage; and recycling the water used for industrial purposes.

On the basis of chemical data collected during 1985–89, a relation was determined between specific conductance and dissolved chloride concentration that can be used to estimate dissolved chloride by multiplying the specific conductance by different factors for low or high conductances.

## SELECTED REFERENCES

- Baker, E.T., Jr., 1964, Geology and ground-water resources of Hardin County, Texas: Texas Water Commission Bulletin 6406, 179 p.
- Bonnet, C.W., 1975, Ground-water data for Orange County and vicinity, Texas and Louisiana, 1971–74: Texas Water Development Board Report 197, 26 p.
- Bonnet, C.W., and Gabrysch, R.K., 1983, Development of ground-water resources in Orange County, Texas, and adjacent areas, 1971–80: Texas Department of Water Resources Report 283, 51 p.
- Bonnet, C.W., and Williams, J.F., III, 1987, Development of ground-water resources in the Orange County area, Texas and Louisiana, 1980–Spring of 1985: U.S. Geological Survey, Water-Resources Investigations Report 87–4158, 50 p.
- Gabrysch, R.K., and McAdoo, G.D., 1972, Development of ground-water resources in the Orange County area, Texas and Louisiana, 1963–71: Texas Water Development Board Report 156, 47 p.
- Harder, A.H., 1960, The geology and ground-water resources of Calcasieu Parish, Louisiana: U.S. Geological Survey Water-Supply Paper 1488, 102 p.
- Harder, A.H., Kilburn, C., Whitman, H.M., and Rogers, S.M., 1967, Effects of ground-water withdrawals on water levels and saltwater encroachment in Southwestern Louisiana: Louisiana Department of Conservation and Louisiana Department of Public Works, Water Resources Bulletin 10, 56 p.
- Hem, J.D., 1989, Study and interpretation of the chemical characteristics of natural water: U.S. Geological Survey Water-Supply Paper 2254, 263 p.
- Jones, P.H., Hendricks, E.L., Irelan, Burdge, and others, 1956, Water resources of southwestern Louisiana: U.S. Geological Survey Water-Supply Paper 1364, 460 p.

- Jones, P.H., Turcan, A.N., Jr., and Skibitzke, H.E., 1954, Geology and ground-water resources of southwestern Louisiana: Louisiana Geological Survey, Geological Bulletin 30, 285 p.
- McAdoo, G.D., 1968, Ground-water data for Orange County and vicinity, Texas and Louisiana, 1968: U.S. Geological Survey Open-File Report, 20 p.
- \_\_\_\_\_, 1969, Ground-water data for Orange County and vicinity, Texas and Louisiana, 1969: U.S. Geological Survey Open-File Report, 22 p.
- \_\_\_\_\_, 1970, Ground-water data for Orange County and vicinity, Texas and Louisiana, 1970: U.S. Geological Survey Open-File Report, 19 p.
- Nyman, D.J., 1984, The occurrence of high concentrations of chloride in the Chicot aquifer system of southwestern Louisiana: Louisiana Department of Transportation and Development, Water Resources Technical Report 33, 75 p.
- Ratzlaff, K.W., 1980, Land-surface subsidence in the Texas coastal region: U.S. Geological Survey Open-File Report 80-969, 19 p.
- Texas Water Commission, 1986, Texas Superfund Notebook, A Briefing on National Priority List Sites in Texas: Texas Water Commission Report LP 86-02, 150 p.
- Turcan, A.N., Jr., Wesselman, J.B., and Kilburn, Chabot, 1966, Interstate correlation of aquifers, southwestern Louisiana and southeastern Texas: U.S. Geological Survey Professional Paper 550-D, p. D231-D236.
- U.S. Environmental Protection Agency, 1996, Drinking water regulations and health advisories: Washington, D.C., U.S. Environmental Protection Agency, 11 p.
- Wesselman, J.B., 1965, Geology and ground-water resources of Orange County, Texas: Texas Water Commission Bulletin 6516, 112 p.
- \_\_\_\_\_, 1967, Ground-water resources of Jasper and Newton Counties, Texas: Texas Water Development Board Report 59, 186 p.
- \_\_\_\_\_, 1971, Ground-water resources of Chambers and Jefferson Counties, Texas, *with a section on Quaternary geology*, by Saul Aronow: Texas Water Development Board Report 133, 183 p.
- Winslow, A.G., and Kister, L.R., 1956, Saline-water resources of Texas: U.S. Geological Survey Water-Supply Paper 1365, 105 p.
- Winslow, A.G., and Wood, L.A., Relation of land subsidence to ground-water withdrawals in the upper Gulf Coast region, Texas: Mining Engineering, v. 11, no. 10, p. 1,030-1,034.
- Wood, L.A., and Gabrysch, R.K., 1965, Analog model study of ground water in the Houston district, Texas, *with a section on Design, construction, and use of electric analog models*, by E.P. Patton, Jr.: Texas Water Commission Bulletin 6508, 103 p.
- Zack, A.L., 1971, Ground-water pumpage and related effects, southwestern Louisiana, 1970, *with a section on Surface-water withdrawals*: Louisiana Department of Conservation and Louisiana Department of Public Works, Water Resources Pamphlet 27, 35 p.

## GLOSSARY

**Aquifer**—A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield substantial quantities of water to wells and springs.

**Confining unit**—A body of markedly less permeable material, stratigraphically adjacent to one or more aquifers, that confines water in the aquifer so that the water level rises above the base of the confining unit.

**Freshwater**—Variously defined as water containing less than 1,000 mg/L dissolved solids or water containing 250 mg/L or less dissolved chloride. In this report, freshwater is defined as water having a dissolved solids concentration of 250 mg/L or less.

**Freshwater/saline-water interface**—The boundary surface between two fluids of different density; the boundary is the sloping surface between freshwater and saline water in this report.

**Saline water**—Water with a dissolved solids concentration equal to or greater than 1,000 mg/L. Four classes of saline water have been defined by Winslow and Kister (1956) according to the concentrations of dissolved solids: (1) slightly saline, 1,000 to 3,000 mg/L; (2) moderately saline, 3,000 to 10,000 mg/L; (3) very saline, 10,000 to 35,000 mg/L; and (4) brine, greater than 35,000 mg/L.

**Saline-water upconing (or vertical intrusion)**—A phenomenon caused when two fluids with different densities at dynamic equilibrium are made dynamically unstable by withdrawal by pumping of the upper or less dense fluid.

**Saline-water encroachment (or intrusion)**—The phenomenon occurring when a body of saline water, because of its greater density or hydraulic head, encroaches (or intrudes) into a body of freshwater.

**Table 1.** Hydrogeologic correlations for Orange County and adjacent counties, Texas

[Modified from Nyman (1984, table 1)]

System	Series	Harder (1960)	Harder and others (1967)	Wesselman (1965)	Wesselman (1971)	This report		
		Hydrologic unit						
Q U A T E R N A R Y	Holocene			Upper aquifer	Upper unit of Chicot aquifer	C h i c o t  a q u i f e r		
	Pleistocene	Chicot shallow	Shallow sand					Upper unit of Chicot aquifer
		“200-foot” sand	Upper sand unit				Clay beds	Clay beds
		“500-foot” sand	Undiffer- entiated lower sand unit	Middle aquifer	Lower unit of Chicot aquifer		Lower unit of Chicot aquifer	
	“700-foot” sand							
T E R T I A R Y	Pliocene	Evangeline aquifer	Evangeline aquifer	Lower aquifer	Evangeline aquifer	Evangeline aquifer		
	Miocene				Burkeville confining unit			

**Table 2.** Average daily rates of ground-water withdrawals for municipal and industrial use from the lower unit of the Chicot aquifer in Orange County, Texas, 1980–89, in million gallons per day

[Data for 1980–84 from Bonnet and Williams, 1987]

Year	Municipal use	Industrial use	Total use
1980	7.5	12.2	19.7
1981	7.3	12.8	20.1
1982	7.4	10.3	17.7
1983	7.2	8.9	16.1
1984	7.0	8.2	15.2
1985	6.7	6.4	13.1
1986	6.5	6.7	13.2
1987	6.4	7.2	13.6
1988	7.1	7.5	14.6
1989	7.1	6.7	13.8

**Table 3.** Average daily rates of ground-water withdrawals from the lower unit of the Chicot aquifer at major industrial sites in Orange County, Texas, 1980–89, in million gallons per day

[Data for 1980–84 from Bonnet and Williams, 1987]

Year	Site A	Site B	Site C	Total
1980	3.9	6.4	1.9	12.2
1981	4.2	6.4	2.2	12.8
1982	3.4	4.7	2.2	10.3
1983	2.2	4.5	2.2	8.9
1984	1.4	4.9	1.9	8.2
1985	.5	3.8	1.2	5.5
1986	.5	3.6	1.5	5.6
1987	.6	3.8	1.7	6.1
1988	.7	4.0	1.5	6.2
1989	.7	3.8	1.3	5.8

**Table 4.** Average daily rates of surface water supplied for municipal and industrial use in Orange County, Texas, 1980–89, in million gallons per day

[Data tabulated by Bill Moltz, Texas Water Development Board. --, data not available]

Year	Municipal	Industrial	Total
1980	--	--	48.6
1981	--	--	58.1
1982	--	--	38.0
1983	--	--	36.5
1984	--	--	41.4
1985	0.1	37.1	37.2
1986	.1	39.4	39.5
1987	.1	42.3	42.4
1988	.1	46.5	46.6
1989	.1	45.1	45.2

**Table 5.** Average daily rates of ground-water withdrawals from the Evangeline aquifer and lower unit of the Chicot aquifer for public supply in eastern Jefferson, eastern Hardin, and southern Jasper Counties, Texas, 1985–89, in million gallons per day

[Data tabulated by Bill Moltz, Texas Water Development Board]

User	1985	1986	1987	1988	1989
Beaumont, Jefferson County	9.8	8.4	7.3	7.2	7.0
Silsbee, Hardin County	1.0	.9	.9	.9	1.0
Lumberton Municipal Utility District, Hardin County	.9	.8	.8	.9	.9
Buna, Jasper County	.2	.2	.3	.3	.3
Evadale, Jasper County	.1	.3	.1	.1	.1
<b>Totals:</b>	12.0	10.6	9.4	9.4	9.3



**Table 6.** Water levels in observation wells in Orange County and adjacent counties, Texas, 1985–90

Owner : WCID, Water Control and Improvement District; CSD, Consolidated School District; Util., Utility;  
ISD, Independent School District; MUD, Municipal Utility District

Depth : Total depth of well

Screen : Top and bottom of screened interval

Altitude : Altitude of land surface datum above sea level

Water level : Feet below land surface

**Orange County****Well UJ–61–56–103**

Owner: B.H. Thibodeau

Depth: 76 feet

Altitude: 23 feet

Date	Water level
04–15–85	11.09
04–28–86	12.15
05–11–87	11.08
04–11–88	11.61
05–31–89	11.43
11–27–89	14.18
04–16–90	11.68

**Well UJ–61–56–314**

Owner: G.C. Hinch

Screen: 375–385 feet

Altitude: 27 feet

Date	Water level
04–15–85	44.20
04–28–86	43.84
04–22–87	42.77
04–11–88	42.34
05–31–89	42.16
11–27–89	43.00
04–16–90	41.47

**Well UJ–61–56–315**

Owner: Iwanda Trailer Park

Screen: 356–380 feet

Altitude: 26 feet

Date	Water level
04–15–85	44.37
04–28–86	44.20
04–22–87	42.31
04–11–88	41.88
05–31–89	41.52
04–17–90	42.19

**Well UJ–61–56–611**

Owner: Larry Brewer

Screen: 441–457 feet

Altitude: 22 feet

Date	Water level
04–18–90	46.90

**Well UJ–61–56–901**

Owner: Orange County WCID 1,  
well 2

Screen: 350–400 feet

Altitude: 21 feet

Date	Water level
04–09–85	50.65
05–02–86	47.42
05–11–87	46.24
04–18–88	47.28
05–31–89	46.76
04–17–90	45.73

**Well UJ–61–56–911**

Owner: Community Water System

Screen: 468–486 feet

Altitude: 12 feet

Date	Water level
04–18–90	37.94

**Well UJ–61–56–919**

Owner: Orange County WCID 1,  
well 3

Screen: 385–420 feet

Altitude: 21 feet

Date	Water level
04–09–85	49.84
05–01–86	49.73
05–11–87	49.06
04–18–88	49.76
05–31–89	49.15
04–17–90	46.66

**Well UJ–61–56–920**

Owner: Orange County WCID 1,  
Wexford Park

Depth: 380 feet

Altitude: 11 feet

Date	Water level
04–15–85	47.54
05–02–86	48.87
04–22–87	45.64
05–31–89	44.30
04–18–90	45.92

**Well UJ–61–56–922**

Owner: Orange County WCID 1,  
well 4

Screen: 284–490 feet

Altitude: 26 feet

Date	Water level
04–09–85	58.24
04–17–90	51.09

**Well UJ–61–56–923**

Owner: Orange County WCID 1, Tiger  
Lake

Screen: 430–460 feet

Altitude: 16 feet

Date	Water level
04–18–90	45.33

**Well UJ–62–49–503**

Owner: G.L. Linscomb

Depth: 117 feet

Altitude: 26 feet

Date	Water level
04–08–85	8.74
04–29–86	11.16
04–22–87	9.46
04–18–88	9.41
05–31–89	8.98
04–17–90	9.23

**Table 6.** Water levels in observation wells in Orange County and adjacent counties, Texas, 1985–90—Continued**Well UJ–62–49–804**

Owner: Parkview Subdivision  
 Screen: 470–490 feet  
 Altitude: 14 feet

Date	Water level
04–17–90	38.55

**Well UJ–62–49–904**

Owner: Texas Department of  
 Transportation  
 Screen: 399–415 feet  
 Altitude: 16 feet

Date	Water level
04–30–86	39.45
05–12–87	38.75
04–18–90	37.75

**Well UJ–62–50–107**

Owner: Mauriceville Water Supply  
 Corp., well 4  
 Screen: 680–730 feet  
 Altitude: 26 feet

Date	Water level
04–28–90	<sup>1</sup> 38

<sup>1</sup> Reported by well owner.

**Well UJ–62–50–201**

Owner: Boyce N. Ward  
 Screen: 476–586 feet  
 Altitude: 26 feet

Date	Water level
04–08–85	44.12
04–29–86	43.36
04–22–87	40.02
04–18–88	41.62
05–31–89	41.24
04–18–90	45.03

**Well UJ–62–50–807**

Owner: Henry L. Wilson  
 Screen: 442–454 feet  
 Altitude: 20 feet

Date	Water level
04–09–85	46.60
05–05–86	46.37
05–13–87	43.65
04–19–88	42.86
05–31–89	42.52
04–18–90	42.65

**Well UJ–62–50–808**

Owner: H.D. Womack  
 Screen: 643–655 feet  
 Altitude: 20 feet

Date	Water level
04–09–85	48.15
05–05–86	47.31
05–13–87	46.36
04–19–88	45.11
05–31–89	44.55
04–18–90	45.40

**Well UJ–62–50–911**

Owner: City of Orange, well 9  
 Screen: 454–618 feet  
 Altitude: 12 feet

Date	Water level
04–10–85	44.10
04–21–87	40.56
04–23–90	41.97

**Well UJ–62–50–912**

Owner: Little Cypress-Mauriceville  
 CSD  
 Screen: 460–510 feet  
 Altitude: 16 feet

Date	Water level
05–12–87	48.0

**Well UJ–62–51–103**

Owner: Inland-Orange Inc.  
 Screen: 445–515 feet  
 Altitude: 25 feet

Date	Water level
04–09–85	40.71
05–08–86	41.15
05–13–87	42.28
04–18–88	39.25
06–05–89	37.52
04–18–90	39.04

**Well UJ–62–51–104**

Owner: Inland-Orange Inc.  
 Screen: 460–470 feet  
 Altitude: 24 feet

Date	Water level
04–18–90	41.54

**Well UJ–62–51–707**

Owner: J.M. Huber Co.  
 Screen: 428–488 feet  
 Altitude: 12 feet

Date	Water level
04–09–85	46.52
05–08–86	42.70
04–22–87	44.42
04–18–88	42.08
06–06–89	39.74
04–19–90	42.29

**Well UJ–62–57–203**

Owner: Joe M. Heinen  
 Depth: 740 feet  
 Altitude: 18 feet

Date	Water level
04–09–85	45.31
05–02–86	46.43
04–21–87	45.87
04–12–88	45.46
06–06–89	45.02
04–18–90	42.33

**Well UJ–62–57–401**

Owner: Texas Eastern Gas Pipeline  
 Co.  
 Screen: 448–468 feet  
 Altitude: 16 feet

Date	Water level
04–11–85	48.84
04–30–86	43.09
05–14–87	44.80
04–13–88	45.22
06–06–89	44.55
04–19–90	40.91

**Well UJ–62–57–403**

Owner: Gulf States Util. Co., Vidor,  
 well 1  
 Screen: 433–483 feet  
 Altitude: 15 feet

Date	Water level
04–09–85	42.89
04–29–86	43.14
04–12–88	41.30
06–02–89	39.95
04–20–90	40.53

**Table 6.** Water levels in observation wells in Orange County and adjacent counties, Texas, 1985–90—Continued**Well UJ–62–57–404**Owner: Gulf States Util. Co., Vidor,  
well 2

Screen: 430–481 feet

Altitude: 16 feet

Date	Water level
04–09–85	44.90
04–20–87	41.04
04–12–88	40.88
06–02–89	40.82
04–19–90	42.14

**Well UJ–62–57–405**Owner: Gulf States Util. Co., Vidor,  
well 3

Screen: 430–480 feet

Altitude: 18 feet

Date	Water level
04–09–85	46.20
04–29–86	44.84
04–20–87	43.78
04–12–88	44.81
06–02–89	39.70
04–19–90	42.14

**Well UJ–62–57–406**Owner: Gulf States Util. Co., Vidor,  
well 6

Screen: 430–480 feet

Altitude: 15 feet

Date	Water level
04–09–85	44.82
04–29–86	41.43
04–20–87	38.85
11–22–89	35.40
04–19–90	35.93

**Well UJ–62–57–407**Owner: Gulf States Util. Co., Vidor,  
well 4

Screen: 320–370 feet

Altitude: 6 feet

Date	Water level
04–09–85	30.60
04–29–86	27.30
04–20–87	21.58
06–02–89	4.69
04–19–90	3.84

**Well UJ–62–57–408**Owner: Gulf States Util. Co., Vidor,  
well 5

Screen: 343–383 feet

Altitude: 6 feet

Date	Water level
04–09–85	31.36
04–29–86	27.93
04–20–87	25.59
04–12–88	24.69
06–02–89	22.23
04–19–90	26.22

**Well UJ–62–57–409**

Owner: Ted B. Michael

Screen: 550–640 feet

Altitude: 13 feet

Date	Water level
04–09–85	43.05
04–29–86	42.54
05–14–87	41.68
04–12–88	42.65
06–02–89	41.07
04–20–90	40.40

**Well UJ–62–57–501**Owner: Enron Gas Pipeline Operating  
Co.

Screen: 405–435 feet

Altitude: 16 feet

Date	Water level
04–09–85	41.60
05–02–86	40.24
04–21–87	41.14
04–12–88	40.17
06–02–89	38.81

**Well UJ–62–57–904**Owner: Gulf States Util. Co., Sabine,  
well 4

Screen: 432–455 feet

Altitude: 10 feet

Date	Water level
05–13–87	88.23
04–20–90	97.65

**Well UJ–62–57–905**Owner: Gulf States Util. Co., Sabine,  
well 5

Screen: 422–461 feet

Altitude: 8 feet

Date	Water level
04–20–90	98.46

**Well UJ–62–57–907**Owner: Gulf States Util. Co., Sabine,  
well 7

Screen: 604–654 feet

Altitude: 10 feet

Date	Water level
05–13–87	46.76
04–20–90	37.30

**Well UJ–62–57–908**Owner: Gulf States Util. Co., Sabine,  
well 8

Screen: 573–623 feet

Altitude: 10 feet

Date	Water level
04–16–85	41.25
05–08–86	41.11
04–20–90	35.72

**Well UJ–62–57–909**Owner: Gulf States Util. Co., Sabine,  
well 9

Screen: 410–460 feet

Altitude: 10 feet

Date	Water level
04–20–90	106.42

**Well UJ–62–58–208**

Owner: J.M. Huber Plastics, well 2

Screen: 509–539 feet

Altitude: 14 feet

Date	Water level
07–01–89	<sup>1</sup> 50

<sup>1</sup> Reported by well owner.

**Table 6.** Water levels in observation wells in Orange County and adjacent counties, Texas, 1985–90—Continued**Well UJ–62–58–304**

Owner: Orange County WCID 2,  
well 1

Screen: 626–706 feet  
Altitude: 10 feet

Date	Water level
04–10–85	47.70
04–30–86	41.33
04–21–87	49.14
04–12–88	47.62
04–23–90	47.38

**Well UJ–62–58–305**

Owner: City of Orange, well 8  
Screen: 520–610 feet  
Altitude: 11 feet

Date	Water level
04–10–85	51.36
05–01–86	44.31
04–21–87	46.11
04–21–88	43.72
06–05–89	41.13
04–23–90	43.93

**Well UJ–62–58–324**

Owner: City of Pinehurst, well 1  
Screen: 365–445 feet  
Altitude: 14 feet

Date	Water level
04–10–85	56.73
05–01–86	52.12
05–14–87	44.58
04–21–88	43.15
06–05–89	41.60
04–24–90	46.24

**Well UJ–62–58–325**

Owner: Orange County WCID 2,  
well 2  
Screen: 620–670 feet  
Altitude: 12 feet

Date	Water level
04–10–85	44.97
04–30–86	47.18
04–21–87	51.78
04–12–88	49.25
06–05–89	47.40
04–23–90	45.03

**Well UJ–62–58–326**

Owner: City of Pinehurst, well 2  
Screen: 530–600 feet  
Altitude: 14 feet

Date	Water level
04–24–90	45.10

**Well UJ–62–58–403**

Owner: Orangefield ISD  
Screen: 460–480 feet  
Altitude: 15 feet

Date	Water level
04–09–85	43.03
04–30–86	43.48
04–20–87	43.70
04–12–88	44.15
06–05–89	44.02
04–24–90	44.05

**Well UJ–62–58–410**

Owner: Orangefield Recreation Park  
Screen: 110–120 feet  
Altitude: 5 feet

Date	Water level
04–09–85	7.70
04–30–86	4.14
04–20–87	4.02
04–12–88	3.07
04–24–90	3.24

**Well UJ–62–58–514**

Owner: Doan's Nursery  
Depth: 400 feet  
Altitude: 8 feet

Date	Water level
04–19–90	7.44

**Well UJ–62–58–515**

Owner: Doan's Nursery  
Depth: 275 feet  
Altitude: 8 feet

Date	Water level
04–19–90	10.20

**Well UJ–62–58–602**

Owner: Ernest H. Willey  
Depth: 711 feet  
Altitude: 14 feet

Date	Water level
04–10–85	50.10
04–30–86	47.97
05–12–87	48.15
04–12–88	40.65
05–31–89	40.38
04–24–90	12.51

**Well UJ–62–58–603**

Owner: W.H. Stark Estate  
Depth: 204 feet  
Altitude: 8 feet

Date	Water level
04–10–85	10.53
05–05–86	10.57
05–12–87	11.12
04–13–88	9.71
05–31–89	9.90
04–24–90	9.57

**Well UJ–62–58–605**

Owner: Chevron Chemical Co., well 4  
Screen: 604–717 feet  
Altitude: 7 feet

Date	Water level
04–11–85	51.88
04–25–90	49.99

**Well UJ–62–58–606**

Owner: James River Corp., well 3  
Screen: 630–710 feet  
Altitude: 7 feet

Date	Water level
04–24–90	42.90

**Well UJ–62–58–608**

Owner: Allied-Signal Inc.  
Screen: 620–735 feet  
Altitude: 8 feet

Date	Water level
04–10–85	47.00
04–30–86	43.48
04–21–87	51.60
04–12–88	44.53
05–31–89	43.14
04–24–90	45.74

**Table 6.** Water levels in observation wells in Orange County and adjacent counties, Texas, 1985–90—Continued**Well UJ–62–58–609**

Owner: E.I. DuPont Co., well 103–3  
 Screen: 634–723 feet  
 Altitude: 11 feet

Date	Water level
04–12–85	47.35
05–06–86	45.14
05–12–87	45.92
04–19–88	46.11
06–01–89	45.10
04–24–90	46.40

**Well UJ–62–58–610**

Owner: E.I. DuPont Co., well 103–3.1  
 Depth: 715 feet  
 Altitude: 7 feet

Date	Water level
04–12–85	48.02
05–06–86	46.67
05–12–87	46.35
04–19–88	45.19
06–01–89	45.33
04–24–90	45.60

**Well UJ–62–58–611** (equipped with A–35 graphic recorder)

Owner: E.I. DuPont Co., well 103–2  
 Depth: 715 feet  
 Altitude: 8 feet

Date	Water level
02–20–85	46.95
04–08–85	47.22
11–04–85	46.76
02–27–86	45.81
05–08–86	45.00
08–20–86	45.20
10–28–86	46.71
03–25–87	45.20
05–12–87	45.12
08–05–87	46.56
04–12–88	44.90
10–25–88	46.00
06–01–89	45.09
11–22–89	45.49
04–24–90	45.48

**Well UJ–62–58–613**

Owner: E.I. DuPont Co., well 103–1.1  
 Depth: 723 feet  
 Altitude: 10 feet

Date	Water level
04–12–85	47.17
05–06–86	44.88
05–12–87	45.13
04–19–88	45.55
06–01–89	36.70
04–24–90	45.55

**Well UJ–62–58–614**

Owner: E.I. DuPont Co., well 103–1  
 Depth: 726 feet  
 Altitude: 11 feet

Date	Water level
04–12–85	49.39
05–06–86	47.04
05–12–87	46.16
06–01–89	47.61
04–24–90	47.72

**Well UJ–62–58–615**

Owner: Firestone Petrochemical Center, well P–817  
 Screen: 611–700 feet  
 Altitude: 9 feet

Date	Water level
04–10–85	45.63
04–30–86	45.91
04–21–87	46.67
04–19–88	47.37
06–01–89	46.42
04–25–90	43.76

**Well UJ–62–58–616**

Owner: Chevron Chemical Co., well 2  
 Depth: 718 feet  
 Altitude: 7 feet

Date	Water level
04–11–85	48.42
05–06–86	45.78

**Well UJ–62–58–618**

Owner: E.I. DuPont Co., well 103–6  
 Screen: 637–682 feet  
 Altitude: 5 feet

Date	Water level
04–12–85	43.48
05–06–86	41.78
05–12–87	42.35
04–24–90	41.85

**Well UJ–62–58–629**

Owner: Firestone Petrochemical Center, well P–821  
 Screen: 595–680 feet  
 Altitude: 5 feet

Date	Water level
04–26–90	44.61

**Well UJ–62–58–631**

Owner: Firestone Petrochemical Center, well P–826  
 Screen: 585–680 feet  
 Altitude: 6 feet

Date	Water level
04–10–85	53.16

**Well UJ–62–58–632**

Owner: Polysar Gulf Coast, Inc., well 1  
 Screen: 640–710 feet  
 Altitude: 8 feet

Date	Water level
04–24–90	38.34

**Well UJ–62–58–633**

Owner: Polysar Gulf Coast, Inc., well 2  
 Screen: 625–725 feet  
 Altitude: 5 feet

Date	Water level
04–10–85	38.39
05–05–86	36.14
04–24–87	37.60
04–13–88	35.91
06–05–89	35.38
04–25–90	37.18

**Table 6.** Water levels in observation wells in Orange County and adjacent counties, Texas, 1985–90—Continued**Well UJ–62–58–634**Owner: Polysar Gulf Coast, Inc.,  
well 3

Screen: 615–715 feet

Altitude: 5 feet

Date	Water level
04–10–85	43.93
05–05–86	41.41
04–24–87	42.63
04–13–88	43.95
06–05–89	43.55
04–25–90	42.59

**Well UJ–62–58–638**Owner: Chevron Chemical Co.,  
well 6

Screen: 634–735 feet

Altitude: 5 feet

Date	Water level
04–25–90	48.35

**Well UJ–62–58–639**Owner: Polysar Gulf Coast, Inc.,  
well 4

Screen: 620–725 feet

Altitude: 5 feet

Date	Water level
04–10–85	41.11
05–05–86	38.80
04–24–87	42.35
04–13–88	38.66
06–05–89	40.17
04–25–90	41.70

**Well UJ–62–58–640**Owner: Polysar Gulf Coast, Inc.,  
well 5

Screen: 612–718 feet

Altitude: 5 feet

Date	Water level
04–25–90	43.60

**Well UJ–62–58–641**

Owner: E.I. DuPont Co., well 103–6

Screen: 697–702 feet

Altitude: 5 feet

Date	Water level
04–12–85	44.19
05–06–86	42.33
05–12–87	42.23
04–19–88	42.24
06–01–89	42.10
04–24–90	42.36

**Well UJ–62–58–702**Owner: Orange County WCID 3,  
well 2

Screen: 600–672 feet

Altitude: 10 feet

Date	Water level
04–10–85	44.20
04–25–90	41.60

**Well UJ–62–58–708**Owner: Gulf States Util. Co., Sabine,  
well 6

Depth: 465 feet

Altitude: 10 feet

Date	Water level
04–16–85	111.74
04–20–90	92.41

**Well UJ–62–58–709**Owner: Orange County WCID 3,  
well 4

Screen: 617–698 feet

Altitude: 10 feet

Date	Water level
04–10–85	45.75
04–30–86	42.52
04–21–87	42.70
04–13–88	41.32
05–26–89	41.19
04–25–90	40.80

**Well UJ–62–58–809**Owner: Orange County WCID 3,  
well 3

Screen: 570–650 feet

Altitude: 7 feet

Date	Water level
04–25–90	40.80

**Well UJ–62–58–810**

Owner: P.J. Silkwood

Screen: 160–170 feet

Altitude: 5 feet

Date	Water level
04–10–85	8.99
04–30–86	10.01
04–21–87	9.24
05–26–89	8.52
04–26–90	8.96

**Well UJ–62–59–101**Owner: City of Orange,  
well 7

Screen: 555–666 feet

Altitude: 10 feet

Date	Water level
05–01–86	46.74
04–21–87	48.92
04–23–90	47.05

**Well UJ–62–59–103**Owner: City of Orange,  
well 2

Screen: 565–685 feet

Altitude: 9 feet

Date	Water level
04–10–85	48.65
04–21–87	48.86
04–21–88	47.13
06–05–89	45.72

**Table 6.** Water levels in observation wells in Orange County and adjacent counties, Texas, 1985–90—Continued**Well UJ-62-59-105**

Owner: Levingston Shipyard  
Screen: 672–737 feet  
Altitude: 9 feet

Date	Water level
02-20-85	45.80
04-08-85	45.76
11-04-85	45.18
02-27-86	44.32
04-29-86	44.13
08-20-86	46.04
03-25-87	44.02
08-05-87	45.20

**Well UJ-62-59-123**

Owner: City of Orange, well 9  
Screen: 529–643 feet  
Altitude: 10 feet

Date	Water level
04-10-85	43.86
05-01-86	36.84
04-21-87	43.74
04-21-88	42.18
06-05-89	41.28
04-23-90	42.56

**Hardin County****Well LH-61-47-208**

Owner: City of Silsbee, well 3  
Screen: 442–842 feet  
Altitude: 80 feet

Date	Water level
04-11-85	101.73
05-07-86	104.92
04-23-87	96.57
05-25-89	92.02
04-30-90	97.49

**Well LH-61-47-210**

Owner: City of Silsbee, well 2a  
Screen: 782–890 feet  
Altitude: 80 feet

Date	Water level
04-11-85	112.31
05-07-86	116.75
04-23-87	111.17
04-20-88	112.85
05-25-89	111.94
04-30-90	112.29

**Well LH-61-47-304**

Owner: City of Silsbee, well 4  
Screen: 595–905 feet  
Altitude: 80 feet

Date	Water level
04-30-90	103.46

**Well LH-61-47-804**

Owner: Lumberton MUD, well 2  
Screen: 395–458 feet  
Altitude: 55 feet

Date	Water level
04-10-85	61.80
05-07-86	58.47
04-23-87	56.86
04-20-88	60.70
05-26-89	59.39
04-27-90	47.83

**Well LH-61-55-104**

Owner: City of Beaumont, Loeb, well 3  
Screen: 290–765 feet  
Altitude: 40 feet

Date	Water level
05-06-86	<sup>1</sup> 63.5
03-10-87	<sup>1</sup> 58.5
03-01-88	<sup>1</sup> 58.5
03-16-89	<sup>1</sup> 61.5
04-27-90	67.60

<sup>1</sup> Reported by well owner.

**Well LH-61-55-105**

Owner: Lumberton MUD, well 3  
Screen: 343–770 feet  
Altitude: 43 feet

Date	Water level
04-10-85	<sup>1</sup> 72.1
05-07-86	80.53
04-23-87	61.82
04-20-88	74.73
05-26-89	70.50
04-27-90	77.50

<sup>1</sup> Reported by well owner.

**Well LH-61-55-203**

Owner: City of Beaumont, Loeb, well 2  
Screen: 301–775 feet  
Altitude: 26 feet

Date	Water level
04-17-86	<sup>1</sup> 75.5
04-28-87	<sup>1</sup> 55.5
03-01-88	<sup>1</sup> 82.5
03-16-89	<sup>1</sup> 62.5
04-27-90	94.40

<sup>1</sup> Reported by well owner.

**Well LH-61-55-204**

Owner: City of Beaumont, Loeb, well 1  
Screen: 311–780 feet  
Altitude: 25 feet

Date	Water level
05-06-86	<sup>1</sup> 71.0
03-10-87	<sup>1</sup> 57.5
03-01-88	<sup>1</sup> 58.5
02-09-89	<sup>1</sup> 77.5
04-27-90	57.19

<sup>1</sup> Reported by well owner.

**Well LH-61-55-206**

Owner: Lumberton MUD, well 1  
Screen: 380–443 feet  
Altitude: 35 feet

Date	Water level
04-10-85	73.10
04-27-90	66.40

**Jasper County****Well PR-61-48-209**

Owner: Temple-Inland Forest Products Corp.  
Screen: 213–594 feet  
Altitude: 45 feet

Date	Water level
12-10-85	39.18
12-02-86	36.26
04-23-87	33.15
11-10-87	32.28
04-30-90	37.13

**Table 6.** Water levels in observation wells in Orange County and adjacent counties, Texas, 1985–90—Continued**Well PR-61-48-214**

Owner: Southern Pine Co.

Depth: 226 feet

Altitude: 42 feet

Date	Water level
04-11-85	35.65
05-07-86	37.06
04-23-87	35.91
04-20-88	37.32
05-26-89	36.63

**Well PR-61-48-221**

Owner: Temple-Inland Forest Products Corp.

Screen: 723–1,264 feet

Altitude: 45 feet

Date	Water level
12-10-85	200.07
12-02-86	199.47
04-23-87	197.44
04-30-90	200.22

**Well PR-61-48-701**

Owner: Larkin Franklin

Screen: 1,210–1,250 feet

Altitude: 35 feet

Date	Water level
05-01-90	74.50

**Well PR-61-48-702**

Owner: J.C. Chance

Screen: 448–468 feet

Altitude: 30 feet

Date	Water level
04-15-85	45.97
04-28-86	46.13
05-11-87	42.87
04-11-88	42.48
05-26-89	42.02
05-01-90	44.79

**Well PR-62-17-902**

Owner: W.S. Gillespie

Screen: 300–325 feet

Altitude: 119 feet

Date	Water level
12-10-85	33.31
12-02-86	30.30
11-11-87	31.13
05-25-89	30.85
05-01-90	28.51

**Well PR-62-25-308**

Owner: S. Kirbyville Rural Water Supply Corp.

Screen: 575–625 feet

Altitude: 101 feet

Date	Water level
05-02-90	65.79

**Well PR-62-33-211**

Owner: Cougar Country Subdivision

Screen: 495–535 feet

Altitude: 85 feet

Date	Water level
04-12-85	72.38
04-23-87	76.40

**Well PR-62-33-401**

Owner: City of Buna WCID 1, well 2

Screen: 230–275 feet

Altitude: 72 feet

Date	Water level
04-12-85	30.91
04-23-87	29.50
04-20-88	29.70
05-25-89	31.85
05-02-90	29.97

**Well PR-62-33-409**

Owner: City of Buna WCID 1, well 1

Screen: 513–777 feet

Altitude: 72 feet

Date	Water level
04-12-85	89.86
05-07-86	91.83
05-25-89	82.33
05-02-90	87.53

**Jefferson County****Well PT-61-64-502**

Owner: Gulf States Util. Co., Neches, well 3

Screen: 306–435 feet

Altitude: 10 feet

Date	Water level
04-12-85	32.98
05-06-86	32.13
04-24-87	31.96
04-13-88	31.05
05-26-89	30.91
04-26-90	29.69

**Well PT-61-64-509**

Owner: Gulf States Util. Co., Neches, well 2

Screen: 380–542 feet

Altitude: 8 feet

Date	Water level
04-12-85	32.79

**Well PT-63-01-606**

Owner: City of Groves

Depth: 814 feet

Altitude: 5 feet

Date	Water level
04-11-85	32.76
05-06-86	33.14
04-24-87	31.29
04-13-88	30.77
05-26-89	30.16
04-27-90	29.42



**Table 6.** Water levels in observation wells in Orange County and adjacent counties, Texas, 1985–90—Continued

<b>Newton County</b>		<b>Well TZ-62-42-102</b>		<b>Well TZ-62-42-904</b>	
<b>Well TZ-62-18-801</b>		Owner: Frenchies Longron		Owner: L.A. Whidden	
Owner: Texas Forest Service		Screen: 179–429 feet		Depth: 270 feet	
Screen: 186–210 feet		Altitude: 37 feet		Altitude: 34 feet	
Altitude: 115 feet					
Date	Water level	Date	Water level	Date	Water level
04-11-85	40.72	04-08-85	30.94	04-08-85	35.81
05-07-86	42.63	05-07-86	30.41	04-29-86	36.18
04-23-87	41.68	04-22-87	30.10	04-22-87	34.92
04-20-88	41.74	<b>Well TZ-62-42-603</b>		04-18-88	34.52
05-26-89	41.46	Owner: L.S. Arrendell		05-25-89	34.77
05-01-90	40.23	Screen: 184–190 feet		05-02-90	34.22
		Altitude: 22 feet			
		Date	Water level		
		04-08-85	5.96		
		04-29-86	7.81		

**Table 7.** Records of selected wells in Orange County, Texas, 1985–90

Water-bearing unit : CHCTL, lower unit of Chicot aquifer; CHCTU, upper unit of Chicot aquifer

Water level : Reported water levels in feet

Use of water : P, public supply; N, industrial; C, commercial; D, domestic

Type of data available : W, water-level measurements (table 6); Q, chemical analyses (table 8)

[ft, feet; in., inches; CSD, Consolidated School District; --, data not available]

Well number	Owner	Driller	Date completed	Well depth (feet)	Well diameter (inches)	Well screen	
						Total length (ft)	Depth interval (ft)
UJ-61-64-314	David Wilkinson	Jones Water Well Drilling Co.	1985	562	2	10	552–562
UJ-62-50-107	Mauriceville Water Supply Corp.	Baison Water Well Drilling Co.	1990	730	10.75, 6.62	50	680–730
UJ-62-50-912	Little Cypress-Mauriceville C.S.D.	Pascal Water Well Drilling Co.	1987	510	6	50	460–510
UJ-62-58-208	J.M. Huber Plastics	Baison Water Well Drilling Co.	1989	557	8, 4	30	509–539
UJ-62-58-514	Doan's Nursery	Paskell Water Well Drilling Co.	1975	400	4	--	--
UJ-62-58-515	Doan's Nursery	Paskell Water Well Drilling Co.	1983	275	4	--	--

Well number	Water-bearing unit	Altitude of land surface datum above sea level (ft)	Water level		Use of water	Type of data available
			Below land surface (ft)	Date of measurement		
UJ-61-64-314	CHCTL	16	--	--	D	Q
UJ-62-50-107	CHCTL	26	38	04/28/90	P	W
UJ-62-50-912	CHCTL	16	48.0	05/12/87	P	Q, W
UJ-62-58-208	CHCTL	14	50	07/01/89	N	W
UJ-62-58-514	CHCTL	8	--	--	C	Q, W
UJ-62-58-515	CHCTU	8	--	--	C	Q, W

**Table 8.** Chemical analyses of water from selected wells in Orange County, Texas, 1985–90

Owner : WCID, Water Control and Improvement District; ISD, Independent School District; CSD, Consolidated School District; Util., Utilities

Water-bearing unit : CHCTL, lower unit of Chicot aquifer; CHCTU, upper unit of Chicot aquifer

[ft, feet;  $\mu\text{S}/\text{cm}$ , microsiemens per centimeter at 25 degrees Celsius;  $^{\circ}\text{C}$ , degrees Celsius; mg/L, milligrams per liter; --, not measured—water sampled from storage tank]

Well number	Owner	Screened interval or depth (ft)	Water-bearing unit	Date of sample	Specific conductance ( $\mu\text{S}/\text{cm}$ )	pH (standard units)	Temperature ( $^{\circ}\text{C}$ )	Chloride, dissolved (mg/L)
UJ-61-56-614	Pine Forest School District	453–483	CHCTL	11-05-85	622	--	--	56
				10-28-86	718	--	--	90
				10-26-87	646	--	--	66
				10-18-88	709	--	--	80
				11-21-89	670	7.9	22.0	68
UJ-61-56-911	Community Water System	468–486	CHCTL	11-05-85	717	--	--	100
				10-28-86	743	--	--	100
				10-26-87	734	--	--	100
				10-18-88	791	--	--	120
				12-01-89	841	8.1	21.0	130
UJ-61-56-919	Orange County WCID 1, well 3	385–420	CHCTL	11-12-85	490	7.8	22.5	58
				11-03-86	476	7.6	22.5	48
				10-30-87	506	7.5	24.0	48
				10-21-88	495	7.4	23.0	49
				11-21-89	493	7.5	21.5	51
UJ-61-56-922	Orange County WCID 1, well 4	284–490	CHCTL	11-12-85	477	7.9	22.5	50
				11-03-86	471	7.9	22.0	44
				10-30-87	501	7.8	22.0	44
				10-21-88	487	7.6	22.0	47
				11-21-89	488	8.1	21.5	46
UJ-61-56-923	Orange County WCID 1, Tiger Lake	430–460	CHCTL	10-21-88	475	7.7	22.0	34
				04-18-90	471	7.6	21.5	34
UJ-61-64-302	Vidor ISD	521	CHCTL	11-08-85	1,910	--	--	500
				11-05-86	1,960	--	--	490
				10-18-88	1,980	--	--	480
				11-21-89	1,920	7.9	23.5	490
UJ-61-64-306	Larry Brewer	525–545	CHCTL	11-05-85	1,320	--	--	300
				10-28-86	1,580	--	--	370
				10-26-87	1,340	--	--	290
				10-18-88	1,330	--	--	300
				12-01-89	1,380	8.3	22.5	300
UJ-61-64-314	David Wilkinson	552–562	CHCTL	11-05-85	1,630	--	--	400
				10-28-86	1,690	--	--	400
				10-28-87	1,660	--	--	390
				10-17-88	1,630	--	--	390
				11-22-89	1,650	8.0	23.0	380
UJ-62-49-302	Mauriceville Water Supply Corp., well 1	320–350	CHCTL	11-15-85	180	6.9	22.5	16
				11-29-89	225	6.8	21.0	20
UJ-62-49-703	James Smith	693–703	CHCTL	11-12-85	2,340	7.9	23.5	640
				10-29-86	2,330	--	--	640
				11-03-87	2,420	--	--	640
				11-28-89	1,510	8.1	20.0	360

**Table 8.** Chemical analyses of water from selected wells in Orange County, Texas, 1985–90—Continued

Well number	Owner	Screened interval or depth (ft)	Water-bearing unit	Date of sample	Specific conductance ( $\mu\text{S}/\text{cm}$ )	pH (standard units)	Temperature ( $^{\circ}\text{C}$ )	Chloride, dissolved (mg/L)
UJ-62-49-804	Parkview Subdivision	470–490	CHCTL	11-08-85	215	--	--	20
UJ-62-49-904	Texas Department of Transportation	399–415	CHCTL	11-04-85	238	--	--	16
				10-30-86	242	--	--	20
				10-28-87	234	--	--	20
				10-18-88	251	--	--	18
				11-29-89	229	7.5	22.0	15
UJ-62-49-905	Texas Department of Transportation	378–394	CHCTL	11-12-85	237	7.3	23.0	14
				10-21-88	244	--	--	16
				11-29-89	244	7.4	22.0	17
UJ-62-50-106	Mauriceville Water Supply Corp., well 2	445–480	CHCTL	11-15-85	228	7.0	23.0	28
				11-29-89	242	6.6	23.0	29
UJ-62-50-807	Henry L. Wilson	442–454	CHCTL	10-24-88	268	--	--	24
				11-29-89	260	7.2	18.0	23
UJ-62-50-808	H.D. Womack	643–655	CHCTL	11-14-85	625	6.8	23.5	130
				10-31-86	658	--	--	130
				11-02-87	652	--	--	140
				10-24-88	740	--	--	150
				04-18-90	770	6.9	21.0	160
UJ-62-50-910	Little Cypress-Mauriceville CSD	450–500	CHCTL	11-07-85	310	--	--	27
				11-05-86	326	--	--	30
				11-02-87	373	--	--	42
UJ-62-50-911	City of Orange, well 9	454–618	CHCTL	11-14-85	514	7.2	24.5	70
				10-31-86	542	7.3	24.0	79
				10-27-87	617	6.8	24.0	98
				10-25-88	657	7.2	24.0	110
				11-30-89	745	7.3	23.5	130
UJ-62-50-912	Little Cypress-Mauriceville CSD	460–510	CHCTL	10-27-88	314	7.4	23.0	30
				12-05-89	314	7.0	24.5	32
UJ-62-51-706	J.M. Huber Corp.	428–488	CHCTL	11-15-85	349	7.4	23.5	24
				11-05-86	344	--	--	24
				11-02-87	343	--	--	25
				10-27-88	340	7.4	24.0	23
				11-28-89	341	7.2	22.0	27
UJ-62-57-203	Joe M. Heinen	740	CHCTL	11-08-85	446	--	--	53
				10-29-86	455	--	--	51
				10-28-87	442	--	--	51
				10-17-88	463	--	--	51
				12-05-89	458	--	--	54
UJ-62-57-401	Texas Eastern Gas Pipeline Co.	448–468	CHCTL	11-05-85	477	--	--	62
				11-04-86	465	--	--	60
				10-29-87	485	--	--	100
				10-19-88	497	--	--	67
				12-06-89	494	8.4	21.0	68
UJ-62-57-403	Gulf States Util. Co., Vidor, well 1	433–483	CHCTL	11-13-85	1,510	7.9	24.0	380
				11-04-86	1,240	7.6	23.5	300
				10-28-87	1,380	7.5	24.0	350
				10-20-88	1,430	7.5	23.5	350
				11-22-89	1,550	7.8	23.5	380

**Table 8.** Chemical analyses of water from selected wells in Orange County, Texas, 1985–90—Continued

Well number	Owner	Screened interval or depth (ft)	Water-bearing unit	Date of sample	Specific conductance ( $\mu\text{S}/\text{cm}$ )	pH (standard units)	Temperature ( $^{\circ}\text{C}$ )	Chloride, dissolved (mg/L)
UJ-62-57-404	Gulf States Util. Co., Vidor, well 2	430–481	CHCTL	11–13–85	3,580	7.5	24.5	1,100
				11–04–86	1,880	7.7	23.5	510
UJ-62-57-406	Gulf States Util. Co., Vidor, well 6	430–480	CHCTL	10–28–87	1,380	7.5	24.0	350
				10–20–88	1,430	7.6	24.0	360
UJ-62-57-407	Gulf States Util. Co., Vidor, well 4	320–370	CHCTL	11–13–85	1,510	7.7	24.0	380
UJ-62-57-408	Gulf States Util. Co., Vidor, well 5	343–383	CHCTL	11–13–85	1,520	7.8	24.5	380
				11–04–86	1,890	7.7	24.0	490
				10–28–87	1,440	7.6	24.0	350
				10–20–88	1,420	8.0	24.0	360
UJ-62-57-501	Enron Gas Pipeline Operating Co.	405–435	CHCTL	11–08–85	345	--	--	31
				10–29–86	374	--	--	35
				10–29–87	369	--	--	32
				10–17–88	377	--	--	29
				12–06–89	360	--	--	28
UJ-62-57-502	Texaco Inc.	478–528	CHCTL	11–08–85	342	--	--	22
				11–05–86	345	--	--	23
				11–03–87	355	--	--	22
				10–20–88	361	--	--	22
				12–06–89	352	8.1	19.0	22
UJ-62-57-605	Wade Granger	469–489	CHCTL	11–05–85	312	--	--	28
				10–29–86	325	--	--	27
				10–27–87	309	--	--	28
				10–25–88	322	--	--	29
				12–05–89	310	7.8	23.0	29
UJ-62-57-904	Gulf States Util. Co., Sabine, well 4	432–455	CHCTL	11–06–86	470	8.1	23.5	40
				11–04–87	492	7.9	24.0	44
				12–06–89	486	7.9	23.0	47
UJ-62-57-905	Gulf States Util. Co., Sabine, well 5	422–461	CHCTL	11–06–86	554	8.0	23.5	50
				10–26–88	576	7.9	23.5	50
				12–06–89	694	8.1	23.5	78
UJ-62-57-907	Gulf States Util. Co., Sabine, well 7	604–654	CHCTL	11–13–85	1,000	--	--	220
				11–05–86	1,010	8.1	25.0	220
				11–04–87	1,000	7.8	25.0	220
				10–26–88	981	7.7	25.0	220
				12–06–89	992	8.0	25.0	220
UJ-62-57-908	Gulf States Util. Co., Sabine, well 8	573–623	CHCTL	12–06–89	836	8.2	24.5	170
UJ-62-57-909	Gulf States Util. Co., Sabine, well 9	410–460	CHCTL	11–13–85	520	--	--	49
				11–04–87	536	7.9	24.0	44
				10–26–88	524	7.9	24.0	46
				12–06–89	528	8.1	24.0	47
UJ-62-58-304	Orange County WCID 2, well 1	626–706	CHCTL	11–06–85	834	7.4	24.5	170
				11–05–86	835	7.3	24.0	170
				10–28–87	806	7.1	24.5	160
				10–19–88	792	7.4	24.5	140
				12–08–89	851	7.5	24.0	170

**Table 8.** Chemical analyses of water from selected wells in Orange County, Texas, 1985–90—Continued

Well number	Owner	Screened interval or depth (ft)	Water-bearing unit	Date of sample	Specific conductance ( $\mu\text{S}/\text{cm}$ )	pH (standard units)	Temperature ( $^{\circ}\text{C}$ )	Chloride, dissolved (mg/L)
UJ-62-58-305	City of Orange, well 8	520–610	CHCTL	11-14-85	800	6.9	24.5	160
				10-31-86	805	7.1	24.0	160
				10-27-87	796	6.6	24.0	160
				10-25-88	833	7.2	24.0	170
				11-30-89	847	7.1	23.5	180
UJ-62-58-325	Orange County WCID 2, well 2	620–670	CHCTL	11-06-85	749	7.4	24.5	140
				11-05-86	723	7.4	24.0	150
				10-28-87	723	7.1	24.5	140
				10-19-88	825	7.2	24.5	160
				12-08-89	753	7.6	22.5	140
UJ-62-58-326	City of Pinehurst, well 2	530–600	CHCTL	11-07-85	434	7.1	23.5	59
				11-06-86	465	7.1	24.0	64
				10-24-88	420	7.3	24.0	55
				12-08-89	474	7.3	23.0	66
UJ-62-58-402	Orangefield ISD	515–535	CHCTL	11-05-85	387	--	--	45
				10-29-86	402	--	--	46
				10-27-87	380	--	--	46
				10-19-88	354	--	--	33
				12-07-89	556	7.7	20.5	48
UJ-62-58-409	Johnny Sheppard	564–651	CHCTL	11-05-85	967	--	--	210
				11-04-86	974	--	--	210
				10-27-87	960	--	--	210
				10-25-88	941	--	--	210
				12-08-89	365	8.1	23.0	26
UJ-62-58-423	Community Water System	208–215	CHCTU	11-05-85	730	--	--	72
				11-06-86	801	--	--	73
				11-03-87	776	--	--	70
				10-26-88	780	--	--	71
				04-18-90	802	7.8	22.0	70
UJ-62-58-513	Bayou Pines Trailer Park	205–215	CHCTU	11-06-85	863	--	--	65
				10-29-86	864	--	--	66
				10-30-87	857	--	--	71
				10-26-88	840	--	--	65
UJ-62-58-514	Doan's Nursery	400	CHCTL	11-04-87	706	--	--	43
				10-27-88	704	--	--	42
				04-19-90	756	--	--	45
UJ-62-58-515	Doan's Nursery	275	CHCTU	11-04-87	710	--	--	41
				10-27-88	697	--	--	44
				04-19-90	738	--	--	44
UJ-62-58-605	Chevron Chemical Co., well 4	604–717	CHCTL	11-14-85	4,140	7.4	22.5	1,200
				11-06-86	4,070	--	--	1,200
				11-03-87	3,870	7.3	24.5	1,100
				10-26-88	4,020	7.4	24.0	1,200
				12-11-89	1,620	7.6	23.5	420
UJ-62-58-606	James River Corp., well 3	630–710	CHCTL	11-07-85	1,290	7.6	25.0	330
				11-03-87	1,350	7.5	24.5	340
				10-25-88	1,450	7.5	25.0	340
				12-11-89	1,420	7.7	24.0	350

**Table 8.** Chemical analyses of water from selected wells in Orange County, Texas, 1985–90—Continued

Well number	Owner	Screened interval or depth (ft)	Water-bearing unit	Date of sample	Specific conductance ( $\mu\text{S}/\text{cm}$ )	pH (standard units)	Temperature ( $^{\circ}\text{C}$ )	Chloride, dissolved (mg/L)
UJ-62-58-608	Allied-Signal Inc.	620–735	CHCTL	11-06-85	1,800	7.5	25.0	480
				10-30-86	1,760	7.4	24.0	450
				10-29-87	1,730	7.6	24.0	460
				10-18-88	1,900	7.4	26.0	540
				12-12-89	2,760	8.0	22.0	400
UJ-62-58-609	E.I. DuPont Co., well 103-3	634–723	CHCTL	11-14-85	1,050	7.4	23.5	230
				11-04-86	1,040	7.7	25.0	230
				11-03-87	975	7.3	24.5	220
				10-25-88	203	7.6	24.0	30
				12-13-89	806	7.8	23.5	150
UJ-62-58-614	E.I. DuPont Co., well 103-1	726	CHCTL	11-14-85	1,270	7.3	23.0	300
				11-04-86	632	6.9	25.0	140
				11-03-87	1,230	7.1	24.5	280
				10-25-88	639	7.6	23.5	110
				12-13-89	1,230	7.7	19.0	290
UJ-62-58-615	Firestone Petrochemical Center, well P-817	611–700	CHCTL	10-20-88	924	7.4	25.0	190
				12-12-89	2,580	7.8	19.5	740
UJ-62-58-623	A. Schulman Co.	440–460	CHCTL	11-06-85	430	--	--	32
				10-30-86	458	--	--	34
				11-03-87	512	--	--	46
				10-26-88	395	--	--	23
				12-13-89	397	8.1	22.5	25
UJ-62-58-629	Firestone Petrochemical Center, well P-821	595–680	CHCTL	11-06-85	966	7.6	25.0	210
				11-04-86	932	7.6	24.5	200
				10-30-87	940	7.5	24.5	190
				10-20-88	921	7.5	25.0	190
				12-12-89	933	8.0	23.0	190
UJ-62-58-631	Firestone Petrochemical Center, well P-825	585–680	CHCTL	11-06-85	3,610	7.4	24.5	1,100
				11-04-86	3,690	7.5	24.5	1,060
				10-30-87	3,690	7.1	24.5	1,100
UJ-62-58-632	Polysar Gulf Coast, Inc., well 1	640–710	CHCTL	11-07-85	1,250	7.6	25.0	300
				10-30-86	1,240	7.6	24.5	310
				10-29-87	1,320	7.4	24.5	320
				10-19-88	1,370	7.3	25.0	320
				12-12-89	1,330	7.8	21.5	310
UJ-62-58-633	Polysar Gulf Coast, Inc., well 2	625–725	CHCTL	11-07-85	1,970	7.5	24.5	520
				10-30-86	1,960	7.6	24.5	530
				10-29-87	1,990	6.9	24.0	520
				10-19-88	1,220	7.5	24.0	270
				12-12-89	1,950	8.0	22.0	500
UJ-62-58-634	Polysar Gulf Coast, Inc., well 3	615–715	CHCTL	12-12-89	1,710	--	--	420
UJ-62-58-635	R.C.W., Inc.	639–689	CHCTL	11-14-85	375	7.7	24.5	34
				11-06-86	370	--	--	34
				11-03-87	375	--	--	31

**Table 8.** Chemical analyses of water from selected wells in Orange County, Texas, 1985–90—Continued

Well number	Owner	Screened interval or depth (ft)	Water-bearing unit	Date of sample	Specific conductance ( $\mu\text{S}/\text{cm}$ )	pH (standard units)	Temperature ( $^{\circ}\text{C}$ )	Chloride, dissolved (mg/L)
UJ-62-58-638	Chevron Chemical Co., well 6	634–735	CHCTL	11-14-85	1,650	7.4	24.0	420
				11-06-86	1,630	7.7	25.0	400
				11-03-87	1,430	7.4	24.5	320
				10-26-88	1,480	7.5	24.5	360
				12-11-89	1,650	7.6	29.5	430
UJ-62-58-639	Polysar Gulf Coast, Inc., well 4	620–725	CHCTL	11-07-85	1,500	7.6	25.0	360
				10-19-88	1,790	7.5	24.5	450
UJ-62-58-640	Polysar Gulf Coast, Inc., well 5	612–718	CHCTL	10-30-86	1,200	7.6	24.5	280
				10-24-87	1,250	7.6	24.0	290
				10-19-88	1,210	7.5	24.5	290
				12-12-89	1,360	8.0	24.0	310
UJ-62-58-642	Ernest H. Willey	420–426	CHCTL	11-06-85	409	--	--	21
				10-30-86	406	--	--	24
				10-28-87	394	--	--	21
				10-26-88	399	--	--	21
				12-07-89	401	--	--	20
UJ-62-58-701	Texaco Inc.	704	CHCTL	11-05-86	1,030	8.0	24.5	220
				10-26-88	1,010	7.6	25.0	220
UJ-62-58-708	Gulf States Util. Co., Sabine, well 6	465	CHCTL	11-13-85	490	--	--	40
				11-05-86	491	8.3	24.5	49
				11-04-87	519	7.9	24.0	41
				12-07-89	507	8.1	23.5	44
UJ-62-58-709	Orange County WCID 3, well 4	617–698	CHCTL	11-13-85	1,030	8.0	25.0	220
				10-28-86	1,050	7.6	25.0	220
				10-29-87	1,030	7.8	25.0	210
				10-20-88	1,100	7.6	25.0	240
				12-07-89	1,120	8.1	25.0	250
UJ-62-58-809	Orange County WCID 3, well 3	570–650	CHCTL	11-13-85	1,060	8.0	25.0	220
				10-28-86	1,070	7.9	25.0	220
				10-29-87	1,080	7.9	25.0	220
				10-20-88	1,090	8.0	25.0	220
UJ-62-58-810	P.J. Silkwood	160–170	CHCTU	11-13-85	1,200	7.5	23.0	210
				10-28-86	1,190	--	--	210
				10-29-87	1,200	--	--	210
				10-18-88	1,200	--	--	210
				12-07-89	1,140	7.8	21.0	190
UJ-62-59-101	City of Orange, well 7	555–666	CHCTL	11-14-85	790	7.3	24.5	150
				10-31-86	794	7.4	24.0	150
				10-27-87	798	7.1	24.0	150
				10-25-88	809	7.4	24.0	150
				11-30-89	819	7.5	23.5	150
UJ-62-59-123	City of Orange, well 9	529–643	CHCTL	10-25-88	382	7.2	24.0	32
				11-30-89	375	7.5	23.0	36
UJ-62-59-124	Equitable Bag Co.	590–640	CHCTL	11-15-85	750	7.1	24.5	150
				11-05-86	744	7.2	24.0	140
				11-02-87	773	6.9	24.0	160
				10-27-88	777	7.4	24.0	150
				04-19-90	802	7.4	24.0	160